

HORTICULTURAL ABSTRACTS.

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No. 1

Initialled abstracts in the present number are by F. H. Beard, R. J. Garner, M. E. King, S. C. Pearce and H. Wormald of the East Malling Research Station.

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Horticultural Abstracts

Vol. X

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No. 1

MISCELLANEOUS.

Biographical.

1. SHULL, C. A., AND STANFIELD, J. F.
Thomas Andrew Knight—In memoriam.
Plant Physiol., 1939, 14 : 1-8.

634/5

This brief account of the great English horticulturist, Thomas Andrew Knight, 1759-1838, can be commended not only to lovers of good English, since its style is worthy of its subject, but also to practising horticulturists, who will find in it numerous references to early articles on which modern practice is founded. Among papers contributed by Knight to the discussions of the Royal Society of England the following are noted by the present authors. *Observations on the grafting of trees.* In it he discussed the effect of grafting on the spread of disease. *An account of some experiments on the fecundation of vegetables.* Using peas for pollination experiments he observed dominance, recessive behaviour and heterosis almost 80 years before Mendel. *Experiments and observations on the motion of sap in tree.* In tracing the ascent of sap he used a deep coloured infusion of grape skins to locate the translocation tissues and he also used ringing for studies of sap descent in the phloem. Some years later he admitted certain errors in connexion with gravitational studies of sap movement. *On the direction of the radicle and germen during the vegetation of seeds.* In this he described his experiments with beans grown on the circumference of a rotating wheel. His conclusions are given in the present article verbatim. *On the inverted action of the alburnous vessels of trees.* In this he gave an account of the profuse flowering even of very early varieties of potato, which ordinarily do not blossom, when he had prevented the consumption of the carbohydrates by suppressing stolon formation. *On the manufacture of cider and perry, A treatise on the culture of the apple and pear, The Herefordshire Pomona.* He wrote not only of vegetables and fruit but also of aphids and bees and other insects and of various plant diseases. He was a founder member of the Royal Horticultural Society in 1804.

2. MOORE, G. T., GAGER, C. S., AND SHREVE, F.
Daniel Trembley MacDougal, pioneer plant physiologist.
Plant Physiol., 1939, 14 : 191-202, bibl. 120.

551.453 : 581.1

In this brief account of the work and in honour of the 75th birthday of one of America's great plant physiologists, the three authors draw attention to the many contributions MacDougal has made to the advancement of his subject. He is known for his many writings on physiological problems and they are listed here. He was the inventor of the MacDougal dendrograph, which automatically records girth measurement in trees. Among other achievements no less valuable, his work on mutation and on desert ecology has perhaps attracted most attention.

Plant hormones.*

3. THIMANN, K. V.
Recent work on vegetative propagation.

577.15.04

Rep. Proc. 29th annual meeting Nth. Nutgrs' Assoc., 1938, pp. 48-50.

The author gives a brief, very clear account of the why and wherefore of the help afforded to the propagator by auxins. The first step was made 50 years ago when Voechting in Germany

* See also 29, 281, 438.

discovered that, independent of gravity, roots are always formed preferentially at or near the basal end. Later work on grass seedlings showed that the growth of the coleoptile in darkness is controlled by a hormone which is formed in the apex and carried towards the base. This substance was studied and chemically purified in Holland. Work on cuttings next established the fact that root formation was also controlled by a hormone and investigations by Went in Java and the author at Pasadena Calif., showed that this hormone agreed closely in all chemical properties with the growth-promoting hormone. It was also found that the auxins comprise a considerable group of substances some of which can be prepared synthetically. Earlier belief that there is no species specificity among the auxins was confirmed, which means that the same or closely related compounds are probably present in all plants and therefore active without regard to family or order. It is now known that auxin is only one of the factors necessary and root number can often be increased by the addition of sugar, biotin, vitamin B₁, etc. Plants notoriously hard to root such as the apple, ash, oak, walnut, etc., grow and must contain auxin during the growing season. Hence their failure to root can hardly be due to absence of auxin, but must be due to the absence of some other in the complex of factors. Recent trials, although not disclosing the exact identity of these internal factors show that they are controlled largely by the physiological state of the tree from which the cuttings are taken and by the position which the cuttings occupy when on the tree. Considerable success has thus been achieved with white pine, red oak and other notoriously difficult subjects. The auxin, sugar, and other factors may be applied externally and the internal factors must then be controlled by selection of material.

4. METCALFE, C. R., AND TEMPLEMAN, W. G. 577.15.04
Experiments with plant growth-substances for the rooting of cuttings.
Kew Bull., 1939, 8 : 441-56.

The authors give data on efforts made at Kew to root cuttings of a large number of trees, shrubs and herbaceous horticultural plants with the aid of the following growth-promoting substances :— β -indolylacetic acid 20 mg. per litre and ditto 50 mg. per litre ; β -indolylbutyric acid 20 mg. per litre and 50 mg. per litre ; and α -naphthylacetic acid 20 mg. per litre and 50 mg. per litre. There were about 10 cuttings in each treatment and a similar number in the control. The treatment consisted in immersion of $\frac{1}{4}$ -1 inch of the basal end of the cutting in the solution overnight for a period of 14-24 hours.

5. FARRAR, J. L. 577.15.04
Rooting of Norway spruce cuttings.
 Reprinted from *For. Chron.*, Sept. 1939, pp. 12, bibl. 14.

Treating cuttings of Norway spruce with solutions of indolylbutyric acid in concentrations ranging from 2.5 mg. to 100 mg. per litre did not increase the percentage rooting.

6. GUTHRIE, J. D. 577.15.04 : 633.491
Control of bud growth and initiation of roots at the cut surface of potato tubers with growth-regulating substances.
Contr. Boyce Thompson Inst., 1939, 11 : 29-53, bibl. 19.

The effects of the following substances on the sprouting and root initiation of potato tubers when applied to the cut surface are noted and discussed :—potassium salts of 3-indoleacetic acid and of α -naphthaleneacetic acid ; vapour of methyl- or ethyl ester of naphthaleneacetic acid, of ethylene chlorhydrin and of acetonitrile ; indoleacetic and naphthaleneacetic acids. The author concludes that the results offer little support for the idea that the dormancy of potato tubers is regulated by increase or decrease of the amount of auxin-like substances in the tissue.

7. HWANG, Y., AND PEARSE, H. L. 577.15.04
The response of seeds and seedlings to treatment with indolyl-acetic acid.
Ann. Bot., Lond., 1940, 4: 31-7, bibl. 22.

Treatment of the seed of oats and broad beans with dilute solutions of indolyl-acetic acid did not result in increased growth in the seedlings. Higher concentrations retarded growth. Rate of regeneration of lateral buds of decapitated oat seedlings was increased, except in nitrogen-deficient cultures, by adding a dilute solution of indolyl-acetic acid to the seedlings.

8. ROBERTS, J. L., AND ROBERTS, E. 577.15.04
Auxin production by soil microorganisms.
Soil Sci., 1939, 48: 135-9, bibl. 21.

*One hundred and fifty species of actinomycetes, bacteria, and molds from Indiana soils have been tested to determine their capacity to produce plant growth hormones from beef extract-peptone agar. Seventy-five of these species were also tested for auxin production from a synthetic medium without tryptophane. Sixty-six per cent. of the species produced auxin on the organic medium; and 30%, from the constituents of the synthetic medium. [Authors' summary.]

9. TINCKER, M. A. H. 577.15.04
Further experiments with growth substances and the rooting of cuttings.
J. roy. hort. Soc., 1938, 63: 210-29.
 TINCKER, M. A. H., AND UNWIN, C. H.
A further report on root-forming substances used for propagation purposes.
Ibidem, 1939, 64: 554-60, bibl. 17.

These are the second and third accounts of experiments with growth substances in propagation carried out by the author at Wisley. [For the first see *Ibidem*, 61: 510, *H.A.*, 7: 258.] In both long lists occur of plants treated and results achieved. In the second account a good deal of space is devoted to methods used both in applying the substance in paste and solution and to a consideration of the chemicals available, particularly phenylacetic acid, α -naphthaleneacetic acid, β -indolylacetic acid, indolylbutyric acid and the solvents for dry chemicals. In the third account it is noted that application by paste had already given place to application by solution, and the latest method of application by powder such as talc is noted with approval. Tests are reported on the use of vitamin B (aneurin) and nicotinic acid in conjunction with the growth substances, but results were inconclusive. The author stresses the importance to success of the condition of the plant material and the season at which cuttings are taken. A consideration of results leads him to rank the following substances as the most valuable for propagation found so far:—indolylbutyric acid, tetrahydronaphthylidene acetic acid (m.p. 92° C.) and two mixed acids, composition not disclosed. With regard to the plants which still defy the vegetative propagator the author considers that their list would be further reduced if a satisfactory method could be evolved of introducing the chemical into the cambium region.

10. GRACE, N. H. 577.15.04
Vegetative propagation of conifers. I. Rooting of cuttings taken from the upper and lower regions of a Norway spruce tree.
Canad. J. Res., 1939, 17, Sec. C, pp. 178-80, bibl. 1.

Cuttings from the upper and lower regions of a Norway spruce were treated with talc and with talc containing 1,000 p.p.m. indolylacetic acid. Nineteen weeks after planting 48% of the upper cuttings and 86% of the lower cuttings had rooted. These percentages already include and are a very small increase on the number that had rooted at 10 weeks. Hormone treatment slightly increased the number rooting, increased the number of roots per cutting and decreased the mean root length. Lower cuttings produced twice the root length and showed significantly increased mean length of individual roots. Physiological differences are in consequence suggested between cuttings taken from the upper and lower regions of the tree. The work was carried out at the National Research Laboratories, Ottawa.

11. GRACE, N. H. 577.15.04
Vegetative propagation of conifers. II. Effects of nutrient solution and phytohormone dusts on the rooting of Norway spruce cuttings.
Canad. J. Res., 1939, **17**, Sec. C, pp. 312-6, bibl. 8. Issued as *N.R.C.*, No. 839.

Nutrient solution added weekly to the sand in which cuttings of Norway spruce were set greatly increased the number of cuttings rooting and the number that developed new growth, and reduced the number that died. Indolylacetic acid in three concentrations in talc had no effect on the number of cuttings rooted or dead but talc alone increased top growth. Hormone dust treatment effected a significant reduction in the length of root per rooted cutting and the mean root length. It is not certain that under better conditions than those obtaining in the experiments the effect of nutrient solution on the rooting of spruce cuttings would be so marked, but it does seem that it may be valuable in aiding the development of root growth and vigour in conifer cuttings.

12. GRACE, N. H. 577.15.04
Vegetative propagation of conifers. III. Effect of month of collection on the rooting of dormant Norway spruce cuttings.
Canad. J. Res., 1939, **17**, Sec. C, pp. 376-9, bibl. 4. Issued as *N.R.C.*, No. 855.

It appears that the rooting of dormant Norway spruce cuttings depends to a greater extent on the date of collection than on treatment with growth substances.

13. GRACE, N. H. 577.15.04
Effects of plant and animal hormones on the rooting of dust- and solution-treated dormant stem cuttings.
Canad. J. Res., 1939, **17**, Sec. C, pp. 305-11, bibl. 13. Issued as *N.R.C.*, No. 837.

Indolylbutyric acid applied in dusts to dormant stem cuttings of *Lonicera tartarica*, *Spiraea Vanhouttei*, *Cornus alba* and in dusts and solutions to *Ribes odoratum* had significant effects on the number rooted and on individual root length and number in all except *Cornus*. It also increased fresh root weight of *S. Vanhouttei* and green leaf weight of *R. odoratum*. Oestrone similarly applied had no significant effect on rooting, but applied in solution it significantly affected green leaf weight of *R. odoratum*, both alone and in interaction with indolylbutyric acid. Dust and solution treatments compared through *Ribes odoratum* produced 62% and 42% rooting respectively, and a leaf development following the use of dusts was nearly three times that found on solution treated cuttings.

14. GRACE, N. H., AND THISTLE, M. W. 577.15.04
Responses of dormant cuttings of *Lonicera tartarica* to solutions of indolylacetic acid and nutrient salts.
Canad. J. Res., 1939, **17**, Sec. C, pp. 317-20, bibl. 4. Issued as *N.R.C.*, No. 842.

Indolylacetic acid significantly increased the percentage of rooting, the number and total length of roots, the fresh root weight and green leaf weight per group of cuttings treated, the higher concentrations (up to 100 p.p.m.) having the greater effect. Each of the foregoing characters were also significantly increased by the addition of Hoagland's nutrient solution, especially at the lower of the two concentrations used. The conditions of the experiment were not optimum.

15. GRACE, N. H. 577.15.04
Effects of cane sugar, ethyl mercuric phosphate and indolylacetic acid in talc on the rooting of cuttings.
Canad. J. Res., 1939, **17**, Sec. C, pp. 321-33, bibl. 18. Issued as *N.R.C.*, No. 844.

Cane sugar, ethyl mercuric phosphate and indolylacetic acid in talc all affected some of the rooting responses of the herbaceous *Coleus Blumei* and *Iresine Lindenii* and the dormant woody *Lonicera tartarica* and *Physocarpus opulifolius* though not always in the same way, for instance

sugar treatment increased the number of roots on *Iresine* and decreased them on *Coleus* cuttings. The physiological activity of organic mercury was an interesting feature, though how far this was due to the presence of phosphate has yet to be determined. The results as a whole suggest that the dust method of treating cuttings may be used to provide advantageous factors other than those provided by the recognized growth stimulating chemicals.

16. LOCKE, S. B., RIKER, A. J., AND DUGGAR, B. M. 577.15.04 : 632.314
Production of growth substance on peptone broth by crown gall bacteria and related non-gall-forming organisms.
J. agric. Res., 1939, **59** : 519-25, bibl. 17.

"Single-cell bacterial cultures of three organisms (virulent crown gall, attenuated crown gall, and *Bacillus radiobacter*) differing widely in ability to induce overgrowths in plants, but similar in physiology, were found to be similar in their capacity to produce growth substance (β -indoleacetic acid) in peptone broth. . . ." [From authors' summary.]

17. LOCKE, S. B., RIKER, A. J., AND DUGGAR, B. M. 577.15.04 : 632.314 : 635.64
The nature of growth substance originating in crown gall tissue.
J. agric. Res., 1939, **59** : 535-9, bibl. 15.

Growth substances obtained by ether extraction from tomato crown gall tissue, tomato foliage and crown gall culture on peptone broth all appeared to contain either beta-indoleacetic acid or material similar in its sensitivity to acid and alkali. Identification was based on the stability of a crude extract in hot acid and basic solutions. No evidence was obtained of the presence of auxin a or b in these extracts. The growth substance measured might have come either from the plant or from the bacteria. [Authors' summary.]

18. MAURI, N. AND MAURI, G. 631.535 : 631.82 + 577.15.04
Essais d'utilisation pratique du CO₂ en horticulture. (The use of CO₂ in horticulture.)
Rev. Hort. Agric. Afr. N., 1939, **43** : 193-205.

An account is given of the installation in Algeria of apparatus for and the results obtained in the subjection of cuttings to doses of CO₂ with a view to hastening their rooting. Treatment with a 3-5% concentration, administered in the mornings, was the most successful, the covers of the plant containers being removed at night to provide a normal atmosphere. Considerable acceleration of rooting and increased top growth was obtained. When used in conjunction with growth substances the results were even better. It should be mentioned that the plant varieties used are by no means difficult to root by ordinary method. Hydrangeas grown in pots in a similar concentration were superior in size of flower and in general appearance to the untreated controls and fetched 5 francs a piece more in the market.

- CROXALL, H. E., AND OGILVIE, L. 577.15.04 : 631.531.17
The incorporation of growth hormones in seed dressings.
J. Pomol., 1940, **17** : 362-84, bibl. 11.

The paper presents the results of the study at Long Ashton of the effect of a number of combined dressings on the germination and subsequent development of certain pea and dwarf bean varieties. The results of incorporation of plant growth hormones in seed dressings of mercurial and cuprous oxide varied with different external conditions. No one dressing either alone or with added growth promoting substances produced an optimum effect on all varieties under all conditions. Dressings containing 5 p.p.m. of α -naphthaleneacetic acid and mixed naphthaleneacetic acids may be safely used on the seed varieties tested and under some conditions may cause considerable stimulation. It is noted that in field trials with Foremost, Lincoln and Surprise peas the crops obtained with peas treated with hormone-containing dressings were up to 80% greater than those from peas untreated or treated with seed dressings only.

20. FUNKE, G. L. 635.967.2 : 577.15.04

Observations on the growth of waterplants. III.

Reprinted from *Biol. Jaarb. Dodonaea (Ghent)*, 1939 (?), 6 : 334-50, bibl. 9.

The influence of phytohormones on the development of some aquatic plants was studied. The concentrations were usually 3/1,000,000, sometimes less. With *Limnanthemum nymphaeoides* α -naphthaleneacetic, indolylacetic and indolylbutyric acid caused a strong twisting of the petioles and a hyponastic bending of the leaf-blades; naphthaleneacetic acid caused a slight epinastic curvature. In *Vallisneria spiralis* the female flower stalk coiled strongly in solutions of α -naphthaleneacetic, indolylacetic acid and butyric acid, but in other solutions not at all. Development of parthenocarpic fruits was marked in α -naphthaleneacetic but scarcely so in other solutions. In three species of *Nymphaea* twisting of the petioles was caused by α -naphthaleneacetic acid and hyponastic curvature of the blades and inhibition of full expansion by this and by indolylacetic and butyric acid. The same substances and propionic acid also produced abnormally long cell lengths caused by a stretching of the cells. The fact that hormones are capable of causing spiralling both in organs which have a tendency to do so naturally and in those which normally never roll up is noted.

General.

21. ROYAL HORTICULTURAL SOCIETY. 582

The naming of plants.

J. roy. hort. Soc., 1939, 64 : 40-1.

A useful note of the rules for the naming of new species of plants and particularly of horticultural varieties, as accepted by the 11th International Horticultural Congress in Rome in 1935.

22. CHITTENDEN, F. J. 581.144/5

The behaviour of plants. I and II.

J. roy. hort. Soc., 1939, 64 : 73-82, 107-16.

In Part I the author discusses with the aid of scientifically proved facts the hidden developments in outwardly seeming dormant buds and other aspects of dormancy. Part II consists more of matters of observation than definite experiments and contains much interesting plant lore. The subjects discussed are: hardiness, e.g. plants may be hardy in one country and tender in another at the same temperatures; soil selection by plants, often the result of competition rather than of preference; adjustment of growth and flowering period in plants transported from one hemisphere to the other; mutations in some normally stable wild plants under the influence of cultivation, e.g. *Primula malacoides*, and other problems. The papers form the Masters Memorial Lecture for 1938.

23. WILLIS, J. C. 575.3

How plants have found their homes. I and II.

J. roy. hort. Soc., 1939, 64 : 259-71, 299-313.

The Masters Memorial Lecturer for 1939 discusses the theories of evolution by natural selection and mutation and other conceptions which at various times have been framed to explain the origin and maintenance of differences between plant species.

24. CHRISTIDIS, B. G. 519 : 581.084

Variability of plots of various shapes as affected by plot orientation.

Emp. J. agric. Res., 1939, 7 : 330-42.

The author has already postulated in a previous paper* theoretical reasons why long, narrow plots should be less variable than more compact ones of the same area and he here first reviews some published experiments of other workers which confirm his results. Two contradictory ones are vitiated by variation between rows not due to soil heterogeneity. To investigate

* The importance of the shape of plots in field experimentation. *J. agric. Sci.*, 1931, 21 : 14-37.

the effect of orientation on this result, four similar strips, 64 m. \times 16 m., excluding headlands, each inclined 30° to its neighbour, were sown with cotton and harvested so that four blocks of four plots could be imposed on each in five ways. Width-length ratios of 64 : 1, 16 : 1, 4 : 1, 1 : 1 and 1 : 4 were tested, and for all orientations long plots proved the least variable in yield. For numbers of plants, however, the least variable plots were those that extended over most rows. Correlation between yield and plant number was found to be erratic, and significant only for the longest plots. S.C.P.

25. JOHNSON, E. L. 581.145.2 : 537.531
Floral development of certain species as influenced by X-radiation of buds.
Plant Physiol., 1939, 14 : 783-95, bibl. 5.

The material used consisted of *Phlox Drummondii*, *Nicotiana Tabacum*, and *Salpiglossis sinuata*.

26. MALLIK, A. K. 581.11
The exchange of moisture between plant materials and the atmosphere.
Indian J. agric. Sci., 1939, 9 : 457-71, bibl. 10.

The paper describes investigations carried out at the Central Agricultural Meteorological Observatory, Poona, on the diurnal variation of moisture content of various dry plant materials, chiefly grain. The significance of the results in agricultural practice is discussed.

27. BROWN, E. M. 581.084.1
Equipment for the growing of plants at controlled temperatures.
Plant Physiol., 1939, 14 : 517-26, bibl. 11.

Description of equipment installed at the Missouri Experiment Station, Columbia. This includes modifications of temperature, control equipment and the use of standard air-conditioning equipment, both of which are illustrated by photographs and diagrams.

28. HOAGLAND, D. R., AND ARNON, D. I. 663.61 : 581.084.1
The water-culture method for growing plants without soil.
Circ. Calif. agric. Exp. Stat. 347, 1938, pp. 39.

A semi-popular account based on the researches of the Station is here given of the water-culture method as a means of supplying mineral nutrients and water to plants. The significance of other interrelated processes, especially photosynthesis, respiration, transpiration and reproduction is pointed out.

29. MOSHKOV, B. S. 631.541 : 612.014.44 : 581.145.1
Grafting as a means of inducing short-day plants to flower under conditions of continuous light. [Russian.]
Bull. appl. Bot. Leningr., 1937, Ser. A, No., 21, pp. 145-56, bibl. 12.

Experiments conducted for some time by the Physiological Department of the U.S.S.R. Institute of Plant Industry have led to the following conclusions :—Flowering of plants is brought about by some special substance which is thought to be similar to the hormones. This substance appears to be formed in the leaf, whence it moves up to the active growing points which thereupon start a reproductive development. This flowering substance is not specific for plants with different light requirements, i.e. the substance produced by the short-day species under short-day conditions is exactly the same as that produced by the long-day plants under long-day conditions. Hence a short-day plant may be induced to flower under continuous light and a long-day plant under short-day light conditions, once the flowering substance is present which is in each case the same. As long as the substance cannot be produced synthetically the simplest method of supplying the plants with it will be by appropriate grafting. It is apparent that the induction of flowering substances has a wide range of application, particularly in hastening the flowering of perennial seedlings. It should be noted that the flowering substance can be distributed in all directions and thus it can also be passed on from stock to scion. The author foresees some difficulties in obtaining it synthetically.

30. ROBERTS, R. H., AND STRUCKMEYER, B. E. 614.014.44
Further studies of the effects of temperature and other environmental factors upon the photoperiodic responses of plants.
J. agric. Res., 1939, 59 : 699-709, bibl. 6.

Among other phenomena apparent in a large number of plants subjected to varying temperatures and photoperiods the following are noted :—Different plants gave very different responses to photoperiod at different temperatures. Plants grown from cuttings from flowering plants responded differently to photoperiod than did seedlings. The variability of a plant population raised either from seed or clonally was largely dependent on the environment in which the plants were grown. The influence of size of seed on vigour was affected by the same environmental conditions of growth.

31. DOAK, B. W. 581.192
A new method for clarification of plant extracts for the determination of reducing sugars.
N.Z. J. Sci. Tech., 1939, 21 : 90B-6B, bibl. 14.

A study was made at the Plant Chemistry Laboratory, Palmerston North, N.Z., of clarifying reagents for the determination of reducing substances and a method for clarification, suitable for use with plant extracts at a dilution suitable for micro-methods was proposed, with an estimate of its efficiency. The proposed method allows efficient clarification without any loss of fructose or glucose.

32. ELWELL, W. E., AND DEHN, W. M. 547.458.88
Pectic content of plant materials.
Plant Physiol., 1939, 14 : 809-15, bibl. 25.

Comparative, quantitative data are given of the pectic content of a large number of plants or plant parts including apples, grapes, cranberries, carrots, peas and many other vegetables. Also indications are given of the enzyme processes involved in the degradation of pectin.

33. ARNON, D. I., AND STOUT, P. R. 546.56 : 631.8 : 635.64
The essentiality of certain elements in minute quantity for plants with special reference to copper.
Plant Physiol., 1939, 14 : 371-5, bibl. 13.

Copper deficiency symptoms were induced in young tomato plants. Spraying the leaves with a solution of CuSO_4 , containing 0.02 parts Cu per million, brought about recovery and resumption of normal growth of both shoots and roots.

34. ARNON, D. I., AND STOUT, P. R. 631.811.9 : 547.25.77
Molybdenum as an essential element for higher plants.
Plant Physiol., 1939, 14 : 599-602, bibl. 14.

Tomato plants grown in rigidly purified nutrient solutions from which molybdenum was absent developed characteristic deficiency symptoms, namely, a distinct and distinctive mottling of the lower leaves, developing later into a necrosis at the margins and involution of the laminae. Almost all blossoms abscised without setting fruit. The deficiency symptoms were not seen when 1 part of molybdenum as molybdic acid was added to 100,000,000 parts of nutrient solution. Nor were they consistent when ordinary distilled water and C.P. chemicals containing molybdenum as a contaminant were used.

35. JAMESON, D. H., AND SCHMIDT, C. M. 016 : 546.27 : 631.8
Boron as a plant nutrient.
 American Potash Institute, Inc., Washington, D.C. (Mimeograph.) 1939, pp. 40.

This is the first supplement to the bibliography issued by the American Potash Institute and compiled by the same authors in September 1938. The first included references to publications

issued between January 1936 and June 1938, and this latter work references to those issued from July 1938 to December 1938. Both are usefully indexed.

36. DROUINEAU, G. 631.411.3 : 631.8
La pénétration des éléments des engrais dans les sols argilo-calcaires méridionaux. (**Penetration of nutrients into argillaceous-calcareous soils in the south of France.**)

Progr. agric. vitic., 1939, 111 : 461-5, 505-6.

It is suggested that with surface applications of chemical manures the nutrient elements, even when soluble, seldom penetrate to the principal root zone in the case of deep rooting crops, thus the roots keep near the surface and the plants suffer in dry weather. Another point made is that, since the three main elements fail to penetrate equally, any attempt to provide a balanced fertilizer is largely vitiated. The method whereby manures are placed at the required depth in holes made by a crowbar around the tree is suggested as having possibilities.

37. MATHIEU, G. 631.67
L'irrigation souterraine en Provence. (**Underground irrigation in Provence.**)
Progr. agric. vitic., 1939, 111 : 305-9, bibl. 9.

The present position of underground irrigation in Provence is described. The conclusions are drawn that underground watering is clearly superior to surface irrigation for market gardens, orchards and grain crops. This success arises from its good effect on all the properties of the soil. Experiments have shown that plants so treated assimilate greater quantities of nutrients and are thus more fruitful than plants watered from above. A system known as Cavaillon is suggested for practical agriculture, but is not described. The research station at Avignon has carried out some experiments, the results of which are referred to in this paper.

38. WEST, E. S., AND HOWARD, A. 631.67
Spray irrigation.
Emp. J. exp. Agric., 1939, 7 : 311-8.

A system of spray or sprinkler irrigation developed on the Murrumbidgee Irrigation Areas, New South Wales, is described from the Commonwealth Research Station, Griffith. Speaking generally the advantages, under Australian conditions, over surface irrigation are greater uniformity of distribution and better control over the amount of water supplied, the possibility of use on uneven land of uneven contour without the need of grading, reduction of orchard space taken up by irrigation ditches, simplification of tillage operations and reduction of working costs. This applies only to light soils. On heavy, flat lands spray irrigation is unsuitable for reasons which are given. The paper contains a technical description of the design and layout of the system, and of apparatus and methods.

39. TOMLINSON, F. R. 631.67
Profitability of irrigation farming in the Western Transvaal.
Bull. Dep. Agric. S. Afr. 201, being *Economic Series* 29, 1939, pp. 45, 3d.

The financial success of irrigation farming in the Western Transvaal was found to be closely related to several important factors, the more important of these being the area under irrigation, area under tobacco, area under wheat, value per morgen of tobacco, and yield per morgen of wheat.

40. PITCAIRN, A. 631.67 + 631.459
Soil and water conservation in Cyprus.
Bull. Dep. Agric. Cyprus 5, 1939, pp. 19.

The following measures are recommended for the control of soil and water losses in Cyprus :—Retiring of marginal lands from cereal cultivation, increasing the area under legumes (peas, beans and vetches), limitation of grazing animals, planting trees and native herbage species, terracing and other forms of erosion control. Among trees suggested as suitable for planting on field boundaries, as shelter belts or control strips, are the following :—olive, carob, almond, eucalyptus.

41. KOLESNIKOV, A. I. 634 : 631.536

Transplanting big trees. [Russian.]

Lenin Academy of Agricultural Sciences, Moscow, 1939, pp. 79, bibl. 41.

The principal points in the transplantation of big trees are discussed here in some detail as follows:—Methods used in different countries; tolerance of the different tree species; best time of year; methods of transplanting big trees; transplanting trees with and without a frozen earth-ball round the roots; preparation for transplanting; subsequent treatment of fully grown trees; transplanting tall palm trees; transplanting big fruit trees including citrus.

42. GAPON, E. N. 631.4

Absorption processes in the soils. [Russian.]

Proc. Lenin Acad. agric. Sci., Moscow, 1939, No. 19, pp. 29-31, bibl. 22.

TROPOVA, A. T. 628.84

Description of a Russian hygrostat. [Russian, English summary 7 lines.]

Plant Protection, Leningrad, 1939, No. 19, pp. 145-9, bibl. 14.

TREE FRUITS, DECIDUOUS.

General.

43. WICKENS, G. W. 634.1/8

The fruit industry in Western Australia.

J. Agric. W. Aust., 1939, 16 : 307-13.

The acreage, production and export figures of fruit in W. Australia are discussed. The season 1938-9 saw the highest yield of apples, per acre and in total number of cases, ever known in the country. The actual figures are 181 cases per acre, the nearest approach to this being 148 cases per acre in 1928-9. Much of this increase can be attributed to improved methods on the part of the growers. For the first time a list of the quantities of apples of each variety shipped is available, Granny Smith leading with 329,460 cases, closely followed by Cleopatra 303,452, with Dunn's and Jonathan next with 216,274 and 191,599 cases respectively. Only 789 cases of Cox's Orange Pippin were exported.

44. COMITÉ POMOLOGIQUE (MOROCCO). 634.11 + 634.13

Rapport de la Commission des arbres à fruits à pépins du Comité pomologique, sur la fructification du poirier et du pommier en 1937-8. (***Fruiting of pears and apples in Morocco, 1937-8.***)

Fruits Primeurs, 1939, 9 : 183-8.

The performances of a number of pears and apples cultivated in Morocco are discussed. Most of the pears do well but the apples require some altitude. Certain English apple varieties are recommended as worth further trial but the definitely successful apples are all American or French.

45. MICHELI, A. 634.1/8

La frutticoltura e la viticoltura nella Libia orientale. (***Fruit and vine growing in eastern Libya.***)

Agricoltura colon., 1939, 33 : 581-92.

Eastern Libya owing to climate is unlikely to be able to raise wine or table grapes which will be able to compete on the European market but there would appear to be a future for raisins, in particular those from the Zibibbo variety, once a successful Rupestris du Lot stock can be found. Almonds are the most commonly grown fruit. Other common fruits are peach, pear, plum, apricot, fig, pomegranate. The high salt content in the irrigation waters, i.e. 1-1½%, does not help deciduous fruit growing and entirely eliminates citrus. The cold north winds of spring also appear to eliminate all prospect of sub-tropical fruits or of early production of the deciduous fruits grown.

46. ROYAL HORTICULTURAL SOCIETY. 634.1/7
Hardy fruit in the commercial fruit trials, Royal Horticultural Society's Gardens, Wisley.

J. roy. hort. Soc., 1939, **64**: 80-7.

In addition to the usual notes on varieties of hardy fruits submitted for trial a list of eleven apples liable to damage from lime-sulphur spray is given. A list of eight apples received for trial, which appear to be synonymous with existing varieties, is also given.

47. HOBBS, E. W. 634.22
The plum plantations of Worcestershire.
J. Minist. Agric., Lond., 1939, **46**: 337-45.

The author in this account of the plum industry in Worcestershire discusses the present situation with regard to the established and newer plantations and describes the cultural methods commonly used. The most successful growers are those who plant wide, grow no undercrop and manure highly. Dung is rarely used, but instead shoddy, hoof and horn supplemented by fairly regular dressings of phosphates and less often potash. Soot on heavy soils has proved beneficial both in stimulating the trees and in its effect on soil tilth.

48. BUNYARD, E. A. 634.25 + 634.26
The history and cultivation of the peach and nectarine.
J. roy. hort. Soc., 1938, **63**: 114-21, 170-7.

The history of the peach in the various countries in which it is grown is traced. The methods of cultivation which are described at length are those in use in England.

49. GOT, N. 634.21
L'abricotier en Roussillon. (The apricot in Roussillon.)
Progr. agric. vitic., 1939, **112**: 187-95, 209-13, 226-8, 257-61, 277-80, bibl. 11.

The cultivation of the apricot in Roussillon, France, is described. For economic reasons apricot plantations are usually associated with vineyards, which inconveniences the vine but not the apricot. Peaches on the other hand can be so grown without harm to themselves or the vines beneath. Many old seed-grown trees still exist, their life being about 50 years. Now seed is sown only to provide rootstocks. Three varieties, however, will come true: *Alberge*, *Hollande*, and *Rouge du Roussillon*. Propagation is by shield budding with dormant buds shortly after sap flow has ceased. An expert propagator will achieve 100% success. The rootstocks in use are as follows:—*Reine-Claude* gage, the most popular, gives large fruits maturing 5 days before the free stock, is very adaptable to soil conditions, deep rooting and drought resistant; it produces a vigorous, if uneven, tree and a strong root system; it is prone to suckering, a tendency less pronounced if it is grown from seed rather than from rooted suckers; one reason for its popularity is that the firm union of stock and scion resists the local gales; it is subject to dieback. *Myrobolan* gives more but smaller fruits than *Reine Claude*; it forms a brittle union and should be reserved for low budding and calm areas; if a standard is required it should be double-worked with *Reine Claude* as intermediate; it does not sucker, but is reputed to be short-lived and to impart to the apricot scions a susceptibility to disease. *St. Julien plum*, much used for peach, though little used for apricot; it is difficult to bud because of the thin bark, and it gives small poor-yielding trees, but is useful on heavy or wet land which other stocks will not tolerate. *Black Damas plum* is only used on rich shallow soils with wet cold subsoils; it is reasonably compatible and is easily and successfully budded. *Marianna plum* seems to have a future as a stock for apricot in this district. It appears to be adaptable to many soils and to be vigorous and easily budded. *Free-stock* is much used for early and mid-season but not for late varieties. It is deep-rooting, makes a strong union but is slow growing at first and comes into bearing late; it dislikes an excess of soil humidity and is subject to gumming in compact ground; it imparts longevity and fertility to its scions and on poor soil is fruitful and profitable. Seed selection

from varieties suitable to the locality is undoubtedly worth while. *Peach* is, in this district, reserved for rich deep alluvial soils. Its scion trees come into bearing soon but have a short life. It is moderately vigorous and produces large, well-coloured fruits a week or two before the free stock. If budded on site and not transplanted it lives longer, is more drought-resistant and gives a more vigorous tree. *Almond* is the stock for poor, dry, chalk and gravel soils. The long tap root provides drought resistance. It is not very compatible with apricot and union is not always easy to obtain, it is easily broken and is characterized by a swelling at the joint; the trees produced are small and infertile. The disadvantages may be eliminated and the advantages retained by double-working with the peach as intermediate, the peach being fully compatible with both. *The almond peach* is a new stock found in a wild state in the district of Thuir. Apricots on this stock seem to do well. The article describes cultural methods necessary to produce the best from a fruit which, though usually neglected, responds profitably to careful treatment. The uses and general economics of the crop are also discussed.

50. VERCIER, J.
Notes sur le poirier. (Notes on the pear.)
Progr. agric. vitic., 1939, 111 : 352-6, 378-80.

634.13

The pear is the most exacting of fruit trees in its soil requirements. It is stunted in dry soils, in wet soils it grows freely and then ceases, in chalky soils it becomes chlorotic and dies; it is best suited by a deep well-drained loam such as a good wheat soil. The usual stocks are wild pear seedling and quince. The former produces large trees on good land and is resistant to chlorosis to a certain extent and will stand dry soils, on which it produces a moderate sized tree. The fruit is plentiful but not large, of average quality and usually inferior to that produced on quince stock. Quince, which in a wild state is found largely on calcareous soils, develops calciphobia when grafted with pear and is affected by more than 12% of lime in the soil. Double working is very useful when first class fruit is required from such weak growers as Williams and Passe-Crassane; a vigorous intermediate such as Curé, Beurré Hardy and others is then recommended. Much larger fruits of such choice sorts as Beurré Clairgeau, Belle Angevine and others can be obtained by crown grafting them on the stumps of the two vertical shoots of a fan-trained Comice or Hardy or other vigorous sort. Abnormally large fruits for exhibition purposes are often secured by grafting a few scions of a winter variety onto an early ripening sort. The winter fruits remain on the tree after the legitimate crop is gone and benefit from the entire resources of the tree.

51. SCOVILLE, G. P.
Apple orchards : cost of developing, values, and financial returns.
Bull. Cornell agric. Exp. Stat. 717, 1939, pp. 44.

634.11-1.16

As a result of extensive economic study of western New York conditions the following suggestions are given :—To develop a fruit farm requires ultimately greater financial resources than to buy a farm with bearing orchards. It costs as much to grow the trees on imperfectly drained as on well-drained land, and hence the grower is advised to move to better land rather than to set more orchard on land that is imperfectly drained. The 1935 depression lowered the market values of fruit farms. Growers on land well suited to orcharding who have found apples profitable should consider planting more apples. If financial resources are available, the depression is a good time to develop an orchard. Times are likely to be better when the trees have reached a bearing age. During a depression, transportation and handling costs become highly important economical factors.

52. GEARREALD, T. N.
An economic study of fruit and vegetable wholesaling and jobbing firms in New York City.
Bull. Cornell agric. Exp. Stat. 721, 1939, pp. 67.

658.8 : 634 +635

This is an analysis of financial records of the various wholesaling and jobbing firms. The purpose of the study is to enable all interested parties to understand more clearly the financial

operations of these two groups and to set up standards of comparison, which might be used by wholesaling and jobbing firms in making their businesses more efficient and so reducing costs of distribution.

Propagation.

53. CRIST, J. W. 634.23 : 575.252
Variation and correlation in bud mutants of the Montmorency cherry.
J. agric. Res., 1939, 59 : 393-5, bibl. 3.

The results of observations on bud sports of the Montmorency cherry do not give any apparent support to the theory that bud sports are more likely than the parent to give rise to further variations.

54. CRIST, J. W. 634.23 : 575.252
Photosynthetic studies of mutational barrenness in the Montmorency cherry.
J. agric. Res., 1939, 59 : 547-53.

Investigations on trees propagated from a bud sport of the Montmorency cherry, noticeable for lack of fruit bud formation and subsequent barrenness, show that sufficient photosynthetic activity is displayed but that the nutrients formed go entirely to making vegetative growth. This would appear to be due to a lowered rate of photosynthetic activity, which precludes the necessary excess of nutrients over and above that needed for vegetative growth.

Rootstocks.

55. BLAIR, D. S. 634.11-1.541.11
Present status of the apple rootstock and double-working trials in Eastern Canada.
Sci. Agric., 1939, 20 : 150-4, bibl. 9, being *Contr. Div. Hort. Dep. Agric. Ottawa* 541.

Hardy rootstocks. Anis and Antonovka seedlings are recommended to replace French crab seedlings in Ontario, Quebec and New Brunswick. *Vegetative rootstocks.* East Malling IX is a suitable rootstock for home gardens in Quebec and Eastern Ontario. It is of doubtful commercial value because it requires staking. In Ottawa the rate of growth of McIntosh trees on Anis and Antonovka seedlings and on E.M. XII is vigorous and similar. There is no difference in variability between the seedlings and the clonal stock and therefore the seedlings, being hardier, are to be preferred. Further notes are given on the characters of other East Malling stocks and of Canadian-selected dwarfing clonal stocks. *Double working.* Topworking commercial varieties on the framework branches of hardy Russian apples, particularly Hiberna, results in greatly increased resistance to winter injury.

Root growth.

56. IWATA, H., AND YAMASHITA, Y. 634.13 : 581.144.2
On the root activities of the Japanese pear Nijisseiki. [Japanese.]
J. hort. Assoc. Japan, 1939, 10 : 154-62, bibl. 5.

Root and shoot growth studies in root boxes of the Nijisseiki pear show interrelated seasonal activities between root and shoot and root and fruit growth. Root growth is most vigorous in spring and autumn. Manuring increases root activity and will often minimize the summer and winter slow-down to the point of extinction. While spring-formed roots suberize early, the autumn roots persist in activity and, though few in number, they are thought to play an important part in the nutrition of the tree during the winter. It is apparent that additional manuring and the application thereof not all at one time are worth consideration.

Pollination.

57. MORETTINI, A. 634.13 : 581.162.3
La impollinazione delle principali varietà di pero autoincompatibili. (**Pollination of the chief self-sterile pear varieties grown in Italy.**)
Ital. agric., 1938, 75 : 251-8, bibl. 4.

The author gives the results of three years' pollination experiments with a number of popular pear varieties. As a result he lists what may be considered good and what bad pollinators for the following :—Williams, Easter Beurré, Passe Crassane, Beurré Clairgeau, Bergamotte d'Esperen, Beurré Hardy, Louise Bonne, Coscia, Beurré Diel, Triomphe de Jodoigne, Monsallard, Oliver de Serres, Duchesse d'Angoulême.

58. KOBEL, F., STEINEGGER, P., AND ANLIKER, J. 581.162.3 : 634.11 + 634.13
Weitere Untersuchungen über die Befruchtungsverhältnisse der Apfel- und Birnensorten. (**Further investigations on pollination in apples and pears.**)
Reprinted from *Landw. Jb. Schweiz*, 1939, pp. 160-91, bibl. 35.

On the basis of recent experiments conducted by the Wädenswil horticultural and viticultural institute as well as of trials outside Switzerland, lists are here presented of suitable pollinators for a great number of apple and pear varieties. The principal features of varieties studied are noted.

59. TAYLOR, F. 638.1
Beekeeping for the beginner.
Bull. Dep. Agric. S. Afr. 199, 1939, pp. 108, 1s.
A detailed, copiously illustrated, useful manual.

Growth and nutrition.

60. NAGASAWA, K. 634.13-2.19
Physiological studies of the effect of bagging on the Japanese pear. [Japanese.]
J. hort. Assoc. Japan, 1938, 9 : 165-86, bibl. 11.

The object of bagging is to control the development of corky lenticels in the fruit of the Japanese pear. It was found that enclosing in bags of cellophane, newspaper, wax paper and a material [transcribed as] "Hatron" all reduced lenticel cork if applied at an early stage in the growth of the fruit.

61. SIEGLER, E. A., AND BOWMAN, J. J. 634.11 : 581.144.2 : 631.535.6
Anatomical studies of root and shoot primordia in 1-year apple roots.
J. agric. Res., 1939, 58 : 795-803, bibl. 19.

Illustrated studies are presented on the anatomy of adventive root and shoot primordia in roots of 1-year-old apple seedlings and of clonal material from the varieties Delicious and Florence Crab. Adventive root primordia originate in the region of the vascular cambium, either in ray parenchyma cells in a line with the cambium or in near derivatives of cambium cells not associated with rays. Shoot primordia are organized as a result of meristematic activity of ray parenchyma cells. Shoot primordia in the material examined were generally more completely organized than root primordia. This is thought to explain relatively quick emergence of shoots in certain clones and the resulting mortality due to lack of roots sufficient to support the top growth. The vegetative response of root cuttings of several clones indicates the necessity for successful propagation that root formation should proceed in advance or at least concurrently with shoot formation.

62. BUGINI, F. 581.145.1/2 : 634.1/8
 La differenziazione delle gemme nelle piante arboree da frutto. (**Fruit bud differentiation in fruit trees.**) [Summaries in French, English and German.]
Riv. Frutticoltura, 1939, 3: 271-80, bibl. 27.

The author discusses at some length previous investigations into the period of fruit bud differentiation. According to him Askenasy was the first to make them in 1874. He notes that certain investigators have sometimes noted two periods, and offers a possible explanation, namely, that under strongly continental climatic conditions plants always have a definite period of summer dormancy and that both before and after this period there is a marked increase in growth and fruit bud formation. Lehmann,* in describing a change over from wood- into fruit-bud, considers that we here have a case of spring fruit bud formation. Bugini, on the contrary, believes these buds to have formed at the ordinary time in autumn during a period of weak and retarded vegetative growth. For the last four seasons he has himself made observations on the differentiation of fruit buds in his district in north-central Italy. The periods thus determined are :—apple 15-30 July, pear 20-31 July, peach 10-25 July, plum 12 July-2 August, sweet cherry 15-25 July, acid cherry 25 July-2 August, apricot 30 July-10 August, olive 15-25 March. A study on bud differentiation in the olive will be published separately and one on vines is in progress.

63. BELL, H. P., AND McLELLAN, J. W. 634.11 : 581.145.2
Bud development of the fruit-bearing spur of the Wagener apple.
Canad. J. Res., 1939, 17, Sec. C, pp. 339-59, bibl. 22.

The complete development of the growing tip of the lateral fruit spur of the Wagener apple is traced. The time occupied is four seasons, of which the first three may be divided into six growth phases, each characteristic and different from the others. It is suggested that the changes which occur in the bud in the first half of June in the third year resulting in a broad flat crown, a shallow pro-meristematic tissue, the leaf primordium bases level with the pro-meristem and both pro-vascular strands and pith broadly hemispherical, may be an indication that physiological differentiation of the crown into flower forming tissue is taking place.

64. SIMONOV, I. N. 634.11 : 581.144 : 581.13
Differences in certain biochemical processes in apple buds. [Russian.]
Proc. Lenin Acad. agric. Sci. Moscow, 1939, No. 17, pp. 26-7.

Russian experiments showed that catalytic activity was normally greater in the buds and leaves of summer apple varieties than in those of late (winter) varieties.

65. BUGINI, F. 581.141 : 581.145.2 : 634.11
 Il numero dei semi in rapporto alla grossezza e alla qualità dei frutti nelle nostre piante arboree. (**Number of seeds and its relation to size and quality of fruits.**)
Ital. agric., 1938, 75 : 629-33, bibl. 8.

The author discusses generally the possible effects of missing or imperfect seed on development of fruits and, in particular, his observations on 331 fruits from one tree of the apple variety Reinette du Canada. In this particular case the average weight of entirely seedless apples was 69 g., that of apples with one seed only 88 g., with two seeds 113 g., with three seeds 125 g., with four 135 g., and with five 147 g. It was noted also that the absence of seeds on the side of a fruit tended to be coincident with abnormal and smaller growth on that side. These investigations are to be continued with other plants and varieties and will include notes of the possible influence of seed content on sugar and acid content in fruits.

* Umwandlungen von Blattknospen in Blütenknospen. *Prakt. Ratgeber Obst- u. Gemüseb.*, 1915, No. 3.

66. WAUGH, J. G. 634.11 : 581.13

Some investigations on the assimilation of apple leaves.

Plant Physiol., 1939, **14** : 463-77, bibl. 22.

The author describes in considerable detail his apparatus for the measurement of CO_2 , an air chamber used by him—being a modification of one used by Heinicke—and the system whereby he measured leaf temperatures. Records were kept of air temperature, leaf temperature, barometric pressure, light intensity, leaf area, rate of air flow, condition of leaf under observation, general condition of tree. The leaves examined were of the varieties MacIntosh and Delicious and of seedlings. Results indicated that under fairly uniform conditions the rate of assimilation is irregular, varying from day to day and hour to hour and sometimes showing several maxima in a day. Response in assimilation to changes in light intensity takes place within an hour. There are indications that there is in the assimilation of the apple leaf a transition range over which light intensity and rate of air flow are both limiting factors. In general under fairly uniform external conditions, leaf temperatures of about 38°C . (100.4°F .) seemed to result in reduced assimilation as compared with leaf temperatures of about 30°C . (86°F .). Results of other investigators indicating that the critical temperature for apple leaves is about 35°C . (95°F .) were confirmed.

Cultural practice.

67. McDONALD, S. L. 634.11-1.542.13

Summer topping of apple trees.

Agric. Gaz. N.S.W., 1939, **50** : 611-3.

Summer topping of apple trees has been found beneficial in the Murrumbidgee Irrigation Area as a means of furnishing the current year's growth with laterals or future fruiting arms which in some varieties, especially Granny Smith, are hard to get. Summer topping gives a break of two or more laterals at the point of topping, and at the following winter pruning the leaders need not be shortened back to the usual length of leader growth of untopped trees, thus diminishing the excessive waste of leader growth when pruning in winter. Summer topping should not be attempted for the first two years after planting unless the tree has grown leaders approximately 3 feet in length the previous year. Summer topping is done when the laterals or current year's growths have reached 8-10 inches; then all growth must be topped, the leaders and subleaders being shortened back to about 7 inches, and all other growth not required in the framework of the tree should be cut to 4 inches or so shortened that it does not compete with the leaders.

68. NEW SOUTH WALES DEPARTMENT OF AGRICULTURE. 631.541.44 : 634.11 + 634.13

Reworking apple and pear trees.

Agric. Gaz. N.S.W., 1939, **50** : 560-2.

Methods of topworking by strap grafting and side grafting are described and illustrated.

69. WALKER, W. F. 631.541.44 : 634.1/2

Frame-work grafting of fruit trees.*

J. roy. hort. Soc., 1938, **63** : 429-38.

Methods of frame-working are described. The processes, now much used in Tasmania in converting old trees, are the inverted L bark graft, the V-shaped bark graft, the chisel graft and the awl graft. The stub grafting method first developed in England is also described.

* See also Garner, R. J., and Walker, W. F. Practical methods of frameworking fruit trees. *Sci. Hort.*, 1939, **7** : 7-16.

Idem. The frameworking of fruit trees. *Occas. Pap. imp. Bur. Hort. Plant. Crops*, East Malling, **5** : 1938, 1s.

70. KIDD, F., AND WEST, C. 634.11-1.8 : 664.85.11
The effects of manurial treatments on the keeping qualities of Cox's Orange Pippin apples.

Rep. Fd Invest. Bd. Lond., for 1938, 1939, pp. 143-8, bibl. 1.

The comparisons made are of apples off four rootstocks, I, V, IX and XII, grown on land receiving eight different manurial treatments (NPK, PK, NK, K, P, NP, N and nil). It is noted that the fruit from these experimental plots at East Malling has throughout been below average as regards flavour and liability to shrivel in store. The conditions have, perforce, been unlike those of a normal commercial orchard. In the four years before planting the land was exhausted by three crops of oats and one of wheat and during the whole period of 11 years no humus had been applied. Results tally with those obtained in the previous season. It was again found that at 39° F. (3.9° C.) fungal wastage occurred sooner and to a greater extent on the fruits from all treatments containing no potash than on the fruit from treatments with potash. One year's results (i.e. all that are available) show that the apples off stocks I and V, independently of manurial treatment, have a longer commercial storage life at 39° F. than those off IX and XII. This is due to the earlier onset of shrivelling and loss of flavour in the latter. As regards ground colour there was no appreciable difference, but the fruit from all treatments where potash was omitted was greener than that from treatments which included potash. The flavour was very poor in all cases of potash omission. It was definitely best in fruit from NPK treatments.

71. MANARESI, A., AND MORETTI, A. 634.23-1.8 : 581.145.2
Concimazione azotata precoce e fruttificazione nel ciliege. (The effect of early nitrogenous manuring on the fruiting of cherries.)

Ital. agric., 1938, 75 : 753-5.

The cherry trees submitted to tests were, in 1936, Precoce della Marca, Napoleon and Belle d'Orleans, all on mahaleb stock and in 1937 the same varieties *plus* Durone di Vignola and the acid Minister Podbielski, both on mahaleb, *plus* the local acid cherry on its own roots. In 1936 1.5 kg. of nitrate of lime was spread over the surface under one of each trees of the first three varieties and lightly hoed in, one tree of as far as possible comparable uniformity being marked down as a control in each case and left untreated. At the time of treatment the trees were just starting into vegetative growth and the leaf buds were beginning to open. In 1937, in all cases except one, two trees were used in each case with an equal number as controls. In 1937 1 kg. of nitrate of lime was applied on 9 March and a further 1 kg. on 24 March. The effect on fruit set was noted on 24 April and at time of picking. On 24 April it was found that treatment had in practically every case, with the exception of the local acid cherry where almost no effect could be seen, resulted in increased fruit set. The total increase varied from an average of 12.5% to a maximum of 22.6% in 1936 and from an average of 5.7% to a maximum of 19.8% in 1937. The usual fruit drop occurred in all cases quite independently of treatment and the final figures were greatly in favour of treatment.

72. ANGELI, G. 634.1/2 : 581.192 : 631.8
La caduta prematura del frutto. (Premature fruit fall.)

Ital. agric., 1938, 75 : 787-97.

The author surveys the whole problem of fruit drop, basing his remarks, not only on recent Italian work, but also on that of other European and American workers. In Italy, of late, four definite times of fall have been noticed, namely just before flowering, during or just after flowering, fifteen days after flowering and the last twenty-five days after the third fall. These four phases were particularly noticeable in 1938 in peach and plum and to a lesser degree in pome fruits. The prefloral fall would appear to have been due to sudden wide changes in temperature, but susceptibility to damage in this respect was distinctly varietal in its extent. Most authorities recognize two main falls, the first during or immediately after flowering, and the second some forty days after flowering, in other words the June drop. The extent of these losses are undoubtedly connected with the C/N ratio of the tree. This suggests that the remedy will lie in the proper use of varieties, in standardized rootstocks, which suit locality and scion,

in pruning, manuring, ringing, etc. It is suggested that N manuring should never be done at the time of fruit bud differentiation—in July and August in Italy—or there will be a tendency to wood bud rather than fruit bud formation. At most other times, however, it is useful, and applied in spring it definitely checks fruit fall, especially in trees of not very vigorous growth. The combination of girdling and a quick acting nitrogenous fertilizer such as nitrate of lime about 3 weeks before flowering have proved extremely favourable to fruit set in Italian experiments. The action of N may be explained by the fact that the seeds which are rich in albuminoids and hence of nitrogenous compounds develop quickly after pollination: at this early stage the seeds form a large proportion of the mass of the fruit and thus attract to themselves large amounts of nitrogenous sustenance. A warning must be given, however, against the danger of over-manuring with nitrogen in the spring, since this may result in the N content in July and August being excessive for fruit bud differentiation, in poor colour of fruits and in soft fruits. Girdling—either by constriction or ringing—the branches early in May after an abundant dose of quick acting N fertilizer earlier tends to help bud differentiation in July-August and secondly to increase the C/N ratio in favour of C and thus check the emission of wood buds. Ringing experiments by Müller Thurgau on vines and Heinicke on fruit trees indicate that the double and favourable effect of ringing and manuring is due, not to an increased N ratio, but to a more properly adjusted C/N ratio. Adequate pollination is an important factor in determining the size of the later fruit drop and it has been found that the average number of seeds in fallen fruits is appreciably less than that in fruits which do not fall. Further, pruning shortly before flowering is shown by Italian experiments to favour the development of lateral buds and increase fruit set. The question of water supply is also important. On the one hand it is found that rain and heavy dews are liable to increase the June drop, possibly because the resulting high humidity of the air reduces transpiration and consequently mineral nutrition; on the other hand lack of rain may also contribute to the trouble. Considerable work needs to be done before the method of establishing a working equilibrium can be discovered.

73. DICKSON, G. H. 634.11-1.55-1.8
Some factors affecting the dropping of McIntosh apples.
Sci. Agric., 1939, 19: 712-21, bibl. 15.

As a result of lowered nitrate supply obtained by minimum cultivation at Vineland Experiment Station, Ontario, the percentage of McIntosh drops was reduced and the colour of the fruit improved. Improved cultivation increased yields and with them the percentage of fruit drop. When the increased yield was due to the on-year cropping the percentage of drops was lower. So-called non-dropping sports of McIntosh may be the results of nutritional factors rather than of mutation.

74. PEARSE, H. L. 634.11-1.8: 663.61: 581.084.1
Water-culture studies with apple trees.* II. The seasonal absorption of nitrogen and potassium by Cox's Orange Pippin on Malling rootstocks Nos. IX and XII.
J. Pomol., 1940, 17: 344-61, bibl. 30.

The paper discusses the advantages of water-culture for studying growth and nutrition of apple trees in the light of experiments carried out by the author at East Malling. There was less variability than when similar trees were grown in soil and normal rootstock effects remained unaltered as regards vigour. It was noteworthy, however, that the young trees on vigorous XII (maidens in 1938) flowered and fruited nearly as freely as those on dwarfing IX, a phenomenon which would almost certainly not occur in soil culture. It shows definitely that precocity is not of necessity linked with vigour. Trees on XII absorbed nearly one-third as much again of nitrogen and potassium as those on IX, but the ratio of total growth made to the amount of each of these nutrients absorbed did not differ significantly for the trees on the two rootstocks.

* Pearse, H. L. Apple trees in water culture, *A. R. East Malling Res. Stat. for 1936, 1937*, pp. 131-6, *H.A.*, 7: 566.

75. KOVALEV, N. V. 634.1/7
Wild fruit tree and small fruit resources of the Far East. [Russian.]
Bull. appl. Bot. Leningrad, 1936, Ser. A, No. 18, pp. 21-38, bibl. 12.
 For full abstract of this see *Plant Breed. Abstr.* 7 : 273.

SMALL FRUITS, VINES, NUTS.

76. DULLUM, N. 634.711-1.8
 Forsøg med Gødskning af Hindbaer. (**Raspberry manurial experiments.**)
 [English summary, 4 pp.]
Tidsskr. Planteavl, 1939, 44 : 54-111.

The experiments discussed were carried out on a number of raspberry varieties at the Danish State experiment stations at Blangstedgaard (heavy soil) and Spangsbjerg (sandy soil). Farmyard manure only differed from artificial manure in its effect on the soil by the greater amount of humus resulting from its application (sandy soil only determined). On heavy soil differences between 5 or 10 tons per hectare farmyard manure and artificial fertilizers containing a similar amount of nutrient were not significant, but at 20 tons per hectare farmyard manure gave better results over similar nutrient value in artificials. On light soil there were no differences. Differences in fruit quality and earliness were not significant except in one instance on heavy soil when farmyard manure appeared to give an earlier crop than artificials. On heavy soil nitrogen slightly increased cane growth, phosphorus had no effect on growth; neither affected yield. Potassium applied at the rate of 50 kg. per hectare added to a supply of nitrogen and phosphate increased cane growth by weight 300% and yield 150%. Heavier dressings had no additional effect. No treatments affected quality or time of maturity. On sandy soil responses were poor and variable. Sulphate of ammonia always gave superior results to nitrate of soda, attributed in this case to its more suitable reactions in increasing the soil acidity. Increasing the alkalinity of the soil above pH 7.5 had a detrimental effect on growth and yield. Differences in pH did not affect fruit quality.

77. DARLINGTON, H. T., AND CULVER, L. B. 634.72
Keys to the species of *Ribes* occurring in the Great Lakes region.
Circ. Bull. Mich. agric. Exp. Stat. 170, 1939, pp. 24.

All the native species and three cultivated European varieties of *Ribes* are included in these two keys, which are accompanied by brief descriptions. The winter key is based on observations during the rest period on stem and twig characters, including buds, leaf-scars, spines, prickles, resin-glands and occasionally outer bark. The summer key is based on observations during the growth season on leaves, flowers and fruits, as well as on certain permanent characters.

78. EGUCHI, T., MATSUO, S., AND NAKASHIBA, K. 634.75-1.536 : 581.145.1
Effects of transplanting on the differentiation and development of flower buds in strawberry. [Japanese.]
J. hort. Assoc. Japan, 1939, 10 : 91-108, bibl. 22.

Transplanting strawberries twice during the seedling stage in Japan is advised, since it promotes the differentiation of flower buds. Retarded growth and a reduced number of differentiations result from deferring the transplanting till the differentiation is about to begin.

79. SIMMEN, C. 634.75
 Les fraisiers remontants à gros fruits. (**Perpetual fruiting strawberries with large fruits.**)
Rev. hort., Paris, 1939, 26 : 523-8.

The paper describes the origin of the large-fruited, perpetual fruiting strawberries and the work of the first hybridists. Lines of desirable future work are pointed out.

80. HUSFELD, B. 634.8 + 663.2
 Sonderaufgaben des Forschungsdienstes im Weinbau und in der Weinkellerwirtschaft Deutschlands. (**Special problems of German viticulture and wine production.**)
Forschungsdienst, 1939, 8 : 339-45.

Perhaps the most important task of all is that of the breeder, who is expected to produce vine varieties both valuable for quantity and quality of yield and resistant to disease and bad environmental conditions. The results so far obtained are promising. The chemical control of pests and diseases aims at the elimination or restriction of the use of arsenic and copper preparations by the substitution of other less dangerous sprays and dusts. Of a number of preparations that are either completely free or contain only very small amounts of copper seven have shown promise. Several diseases including "Reisig" disease as well as their symptoms have been analysed. In some cases the causal organisms have been discovered and conditions favourable to their incidence noted. In the course of the study of grafting conditions it has been found that wood maturity of both stock and scion are extremely important. Wood maturity determination experiments are still being carried on at different places under central direction. A method has been worked out the application of which has resulted in a 70% "take" of some 20,000 grafts made. It has been found that ripening depends on the energy radiated from the sun and the sky. There is no delay in ripening on cloudy days in which solar radiation is strong. Harvesting appears to coincide in most cases with the time when the grapes, after accumulating some 5% sugar, start showing a sudden rise in sugar content. Studies on rooting and on external requirements of the different varieties have been started. Soil structure and soil acidity have been brought into relationship with the *Phylloxera* invasions. The section on oenology deals with wine making, cellar treatment proper, must and wine analyses and with the use of waste products.

81. LE PROGRÈS AGRICOLE ET VITICOLE. 634.8
 La viticulture métropolitaine et d'outre mer. (**Viticulture in France and overseas.**)
 Special number *Progr. agric. vitic.*, 2 July, 1939, pp. 100.

This number (separate from the numbered series) has been issued to commemorate the 7th Fête nationale des Vins de France. It contains 28 papers most of which are descriptive of the vineyards and methods of cultivation or wine-making technique peculiar to the more renowned districts. There is one paper on rootstocks, by Prosper Gervais, President of the Société des Viticulteurs de France.

82. CAPUCCI, C. 634.8-1.537
 Alcuni fattori che influiscono sullo sviluppo delle viti durante il primo anno di vegetazione a dimora. (**Certain factors affecting the growth of vines in the first year after planting out.**) [Summaries in French, English and German.]
Riv. Frutticoltura, 1939, 3 : 249-70, bibl. 6.

These two years' observations which were made in different localities in the province of Bologna give indications which should be of practical value. The greatest growth in the first year after planting out occurred in vines, whether grafted or ungrafted, 2 or 3 years old. Two-year-old and, even more, 3-year-old vines showed more deaths during this period than 1-year-old, especially when grafted. Plants which had already been transplanted during their two years in the nursery bed showed worse growth than others. The take of the 2-year-old plants on transplanting was inferior to that of the 1-year-old plants, though superior to those which were 2-3 years in the nursery. Vines transplanted with the greatest possible number of roots into sufficiently large holes to allow proper root distribution gave the best rooting and shoot development. Grafted vines (European on American) showed less growth and slightly less root formation than ungrafted European vines.

83. LAGATU, H., AND MAUME, L. 634.8 : 581.192 : 581.145
La composition NPK des feuilles d'un rameau de vigne Aramon diffère-t-elle selon que ce rameau est plus ou moins fructifère. (**Does the NPK composition of the Aramon vine vary with the degree of fruitfulness of the branch?**)

Progr. agric. vitic., 1939, **112** : 308-10, bibl. 3.

LAGATU, H., AND MAUME, L. 634.8-1.541.11-1.8

Influence de la nature du porte-greffe sur la mode d'alimentation NPK de la vigne greffée. (**The influence of the stock on the NPK nutrition of the grafted vine.**)

Progr. agric. vitic., 1939, **112** : 341-4.

BUZIN, N. P. 634.8 : 581.148

Shedding of flowers and berries in the vineyard and their control. [Russian.]

Novocherkassk, 1939, pp. 20, 1 rouble.

84. BENTON, W. A. 634.5-1.541
Report on propagation of nut trees.

Rep. Proc. 29th annual meeting Nth. Nutgrs' Assoc., 1938, pp. 90-2.

Comparative trials were made of paraffin and rubber latex mixed with aluminium powder as covering for grafts in hickory. Results were slightly, but not conclusively, in favour of the latter method but they need confirmation. Some success was achieved in dormant budding of walnuts using both paraffin and ordinary surgical adhesive tape. There was little to choose between the two. Root grafts of walnuts, callused in damp sawdust in the greenhouse, were also successful, though they did not in their first year show such good growth as the budded plants.

85. SMITH, C. L., AND ROMBERG, L. D. 634.521 : 577.15.04
A method for the treatment of cuttings and roots of the pecan with root-inducing chemicals.

Plant Physiol., 1939, **14** : 177-8.

Full details are given of the authors' toothpick method of applying indolylbutyric acid to cuttings and roots of pecan (see also *H.A.*, 9 : 834). The method is described as follows:—"Ordinary round wooden toothpicks are used as the carriers for the chemical instead of lanolin. The indolebutyric acid is dissolved in 95% ethyl alcohol in the concentration desired. The two ends of each toothpick are cut off leaving the pick 4 cm. long. Then the picks are immersed in the alcoholic solution for 24 hours, after which they are removed and the alcohol allowed to evaporate. Each pick absorbs approximately 0.084 ml. of the solution, and any desired concentration may be obtained by properly adjusting the concentration of the chemical in the alcohol. The picks also absorb approximately the same volume of water as of alcohol, and at approximately the same rate. The chemical, therefore, readily diffuses from the toothpicks when they are placed in the roots. Holes seven-sixty-fourths of an inch in diameter are bored transversely about two-thirds through the cuttings or roots at the desired points by means of an electric drill, and treated toothpicks of sufficient length to fill the holes are inserted." The treated picks, carrying concentrations varying from 0.25 to 4.0 mg. per pick, were found to be just as effective as lanolin mixture in inducing root formation. A concentration of 4 mg. per pick appears from observations made to be excessive.

86. SMITH, C. L., HAMILTON, J., THOR, C. J. B., AND ROMBERG, L. D. 634.521-1.541.44 : 581.144.2
Root composition and top development in large pecan trees headed to various degrees of severity in top working.

J. agric. Res., 1939, **58** : 821-42, bibl. 12.

Pecans of an average diameter of 12 inches and 43 years old at the beginning of the experiments were headed back in 1931 to stumps, first forks, second forks, third forks and fourth forks, prior

to being top-worked to improved varieties. Analyses of roots of these and similar untreated trees were made at intervals from October 1931 to January 1934 for dry matter, reducing and non-reducing sugars, starch, hemicellulose and organic nitrogen. These analyses are here recorded and discussed. The rate of healing of tree wounds occasioned by the heading was about proportional to the leaf area left on the tree. The data, together with observations on the rate and facility of healing of wounds in the different treatments indicate that in heading for top-working cuts of more than 4 inches in diameter should be avoided. Larger cuts heal less readily and, where made, the potential leaf area is so reduced as probably to be inadequate to synthesize enough food for the normal recovery of the tree.

87. THOR, C. J. B., AND SMITH, C. L. 634.521 : 581.145.2
A physiological study of the prefilling period of fruit development in the pecan.
J. agric. Res., 1939, **58** : 905-10, bibl. 2.
 A continuation of studies, *Ibidem* 1935, **50** : 97-121.

88. POLACCO, F. 634.532
Aspetti attuali della castanicoltura da frutto in Italia. (Spanish chestnut growing in Italy.)
Ital. agric., 1938, **75** : 494-500.

A brief account of the cultivation of the edible chestnut in Italy. The chief production is in Liguria, Calabria and Tuscany, the total annual Italian production being from 3-400,000 tons of nuts. Cultural care is small, consisting of removal of suckers and water shoots, cutting out useless or harmful branches and pruning to maintain a proper equilibrium between growth and fruiting. Little manuring is done other than the yearly digging in of old chestnut husks, leaves and other rubbish in the autumn, unless vegetable crops are grown beneath the trees, when the latter benefit from the manuring of the vegetables. Notes are given of pests and diseases. The most important of the latter is the mal di inchiostro or ink disease attributed here to *Phytophthora (Blepharospora) cambivora* [but see *H.A.*, 7 : 72 where Couderc attributes it to *Coryneum* spp.—ED.].

89. VACIRCA, M. 634.54
Sul problema del nocciuolo. (Problems of cob nut production in Italy.)
Ital. agric., 1938, **75** : 183-90, bibl. 1.

Italy exports cob nuts to the value of nearly £1,000,000 a year, Sicily, Campania, and Lazio being the largest producers. Cultivation operations are meagre compared with those adopted in England and, despite occasional pruning, the appearance of the bushes somewhat resembles that of wild hazels in the English countryside. Bushes are very subject to premature nut fall, owing, it is thought, both to inadequate pollination and, more especially, inadequate manuring, and to the ravages of a small beetle, *Balaninas nucum*, which lays eggs in the young fruit. Collection of infected fruits is the only remedy suggested. Plant bugs are also a cause of considerable loss especially *Gonocerus acuteangulatus*, *Carphocoris pudicus* and *Palomena prasina*. They render the kernels insipid or worse. The remedy would appear to lie in spraying or possibly the use of such a predator as *Rhinocorus iracundus*, which is a natural feeder on such pests.

90. LUTRI, I. 634.55
L'Avola Scelta ed altre varietà di mandorlo. (The Avola Scelta and other almond varieties.)
Ital. agric., 1938, **75** : 339-54, bibl. 11.

A detailed description of certain successful Italian almond varieties.

PLANT PROTECTION OF DECIDUOUS FRUITS.

91. RUBY, (COLONEL). 632.13
 La défense contre la grêle dans le Beaujolais au cours de l'année 1938. (**Pro-
 tection against hailstorms in the Beaujolais district during 1938.**)
Progr. agric. vitic., 1939, 111 : 485-8, 524-9, 548-50, 572-7.

The article gives an account of the meteorological conditions leading to the formation of hail and of the factors which cause the storms to follow a more or less stereotyped course. The defence measures for the district of Beaujolais are described. They consist of attacking the storms by means of rapid gunfire. A description of the organization is given. The guns project an explosive charge of 400 grammes of cheddite to a height of 1,300 metres. The district is covered by 84 fixed and 16 mobile batteries ranged along the hill tops. Telephonic communication and observation posts were maintained, usually by arrangement with private persons. During the season May to September, 26 storms were observed and 18 attacked, 3,500 shots being fired. Brief notes are given on most of the storms and the number of rounds fired to effect dispersal in each case is mentioned. The more important storms are fully described. Explanatory maps show the course of three storms and indicate the action taken to deal with them. The measures were entirely successful. During the actions the intrepid colonel was wont to ascend in an aeroplane to the storm clouds the better to observe the results of his barrages. He now suggests bombing the clouds from above and already has a number of experimental bombs under construction. It is also stated that a gun firing 1 kilo of melinite to 3,000 metres is under experiment.

92. DELMAS, —. 632.111
 Les gelées blanches de printemps : les moyens de s'en défendre. (**Defence
 measures against spring frosts in North Africa.**)
Fruits Primeurs, 1939, 9 : 120-4.

The causes of spring frosts are discussed. Measures of defence suggested are :—*Natural*. Avoid working the soil during a frosty period or roll the soil the same day ; remove weeds and litter ; water before frost and again when the thaw starts. *Artificial*. Smoke screens have not been conclusively proved useful in North Africa owing to winds and have been abandoned in U.S.A. and France. The use of orchard heaters is well established in U.S.A. where the high cost can be more easily borne than in North Africa. However, trials with oil heaters were put in hand. The oils were supplied free by the Shell Company. Light fuel oil, consumption per hour 1 kg. ; very smoky and deposited thick soot on the heaters. Domestic fuel oil, consumption .890 kg. ; combustion irregular towards the end. Superior fuel oil, consumption .968 kg. ; flame regular and clear. The orchard temperature was raised about 5° when the outside temperature was at freezing point. Chimney heaters gave better results than spider-type heaters. Following these trials 4 hectares of apricot (Bullida) and 2 hectares of peaches (J. H. Hale and Carman) were heated in March when the fruit was setting and frosts up to -6° C. were being experienced. These orchards were uninjured while the blossom on neighbouring unheated orchards was entirely destroyed.

93. HAVIS, L., AND LEWIS, I. P. 634.1/7-2.111
Winter injury of fruit trees in Ohio.
Bull. Ohio agric. Exp. Stat. 596, 1938, pp. 41, bibl. 18.

On the basis of observations made in Ohio during the severe winter of 1935-36 it is thought that the following practices will reduce winter injury of fruit trees :—(1) Plant on a location as frost-free as possible and deep soil of moderate fertility. (2) Use sod and mulch systems with moderate early fertilizer applications. Apply fertilizers in autumn or very early spring. (3) Drain wet spots in the orchard. (4) Prune fruit trees after severe winter temperatures are over ; this is especially desirable for young trees. Confine early pruning to absolutely necessary operations. (5) Thin the fruit. (6) Use mild sprays. (7) Use hardy stocks such as Hibernial, Virginia Crab. (8) Plant as hardy varieties as possible consistent with market demands.

94. EREMEEV, G. N. 634.1/2-2.1

Oils and oil emulsions for protection of fruit trees from winter injury. [Russian.]

Bull. appl. Bot. Leningr., 1936, Ser. A, No. 20, pp. 123-32, bibl. 25.

Experiments conducted by the Nikita Botanical Gardens in different parts of Russia led to the following conclusions:—1. In districts subject to winter drought it was relatively easy to prevent tree injury (apples and cherries) by coating the trees with films of sunflower seed oil, refined motor oil and similar substances. The loss of water was limited by the treatment to 50%. 2. In the southern districts, particularly in the Crimea, winter injury is mostly due to warm spells in winter followed by sudden frost. 3. Here winter injury can be prevented by planting varieties with prolonged rest periods, which remain unaffected by warm weather spells in winter, or by increasing the hardiness of the plants during the warm winter spells. 4. This can be achieved by spraying the plants with certain oil emulsions, the latter preventing both an excessive warming-up of the buds and a significant increase in respiration of buds and shoots during the warm winter spells. 5. Both these effects aid the buds in maintaining their dormancy and at the same time their resistance to frosts. 6. In the present experiments sprays prolonged the dormancy of the buds by 10-12 days. 7. The decrease in the respiration of buds and shoots during the warm weather in winter, due to spraying, was also useful as regards economy of carbohydrates. The intensity of respiration of one-year-old control apple shoots in the experiments was 0.350 mg. per hour per 1 g. dry substance at 12° C., while at 24° it was 1.02 mg. per hour. The rate of respiration of two-year-old shoots was three times less. 8. A description is given of the properties desirable in the films produced by spraying on the plants. 9. The study of sprays and spraying continues.

95. HUGO, F. C. 632.111 : 634.8

Damage by frost to sultana vineyards along the Orange River.

Fmg S. Afr., 1939, 14 : 395-6.

Investigations at the Research Station, Upington, show that the only effective way of preventing spring frost damage along the Orange River is to prevent early budding. Heaters are uneconomical and not very effective. Delay in budding in spring may be brought about by keeping the orchard irrigated at monthly intervals starting after the harvest and continuing through the spring. Ploughed or hoed land should be immediately irrigated to settle the soil again. Ploughing should take place as late as possible since the soil is warmed by aeration and the buds will shoot in consequence. Late ploughing is somewhat detrimental to the vine but is to be preferred to frost damage. Marked influence can be obtained by late pruning. Examples are given where late pruned vines have been untouched while the earlier pruned have been severely damaged. Late pruning causes excessive bleeding but this again is preferable to frost damage. Damage by the occasional, very late frost can only be limited by watching the weather carefully and irrigating before the frost occurs and by not topping the vines too closely.

96. ROOS, K. 634.23-2.19

Das Kirschbaumsterben im Baselland. (Symptoms of dying off of cherry trees in the Basle district.) [French and German summaries.]

Reprinted from *Landb. Jb. Schweiz*, 1939, pp. 235-58.

A study of diseased cherry trees in Switzerland indicates that the gumming on branches, stem and roots, which eventually leads to the death of the trees, is only a secondary reaction. No clogging was observed of the vessels in the branches, stems or major roots of recently diseased young trees, while the fibrous roots, on the other hand, were dead and some already showed gum formation. The investigations into the causes of poor root growth and dying-off of fibrous roots are being continued.

97. PONTIS, R. E. 634.11-2.19

El "bitter pit" de la manzana en la Provincia de Mendoza. (Bitter pit of apples in Mendoza Province, Argentine.)

Rev. B.A.P., 1939, 22 : 263 : 31-4.

A description of bitter pit of apples is given. In Mendoza Province, Argentine, the varieties which develop it are Northern Spy and Stayman. Conditions which seem to increase

susceptibility are :—soils which are physically and mechanically of poor quality, especially if dry and deficient in humus ; frequent extremes of wet and dry weather especially at the end of the season ; under-irrigation early in the year followed by over-irrigation at the end of the season ; too hard pruning which results in fruiting on the main branches instead of on well distributed laterals ; fluctuation of temperature during ripening. Pit developing in storage is mentioned. Preventive measures aiming at a neutralization of these factors are given.

98. BRIEN, R. M. 632.1/4 + 632.8
A list of plant diseases recorded in New Zealand.
Bull. N.Z. Dep. sci. industr. Res. **67**, 1939, pp. 39, bibl. 91, being *Plant Diseases Div. Bull.* **21**.

Some 400 plant diseases occurring in nature in New Zealand are here listed. The list, which is arranged under botanical names of hosts, includes diseases of fungoid, bacterial, virus and physiological origin.

99. DENMARK. 632.1/8
Plantesygdomme i Danmark 1938. (**Plant diseases and pests in Denmark 1938**.) [English summary, 1½ pp.]
Tidsskr. Planteavl., 1939, **44** : 1-53.

The paper mentions with brief notes all the pests and diseases including deficiency diseases observed in Denmark during 1938 by the State plant pathologists. Seven fungi and two insect pests are reported for the first time from Denmark.

100. OTSUKA, Y. 634.11-2.8
A new disease of the apple in Manchukuo. [Japanese.]
J. hort. Assoc. Japan, 1938, **9** : 282-6, bibl. 5.

The author claims to have discovered a new virus disease of apples in Manchukuo which he has transmitted by grafting. The disease seems to be confined to varieties with an upright habit of growth and the symptoms appear to differ with the variety.

101. NOBLE, R. J., AND NOBLE, N. S. 588.427 : 632.8 : 632.753
Aphid vectors of the virus of woodiness or bullet disease in passion fruit
(*Passiflora edulis* Sims).
Reprinted from *J. roy. Soc. N.S.W.*, 1939, **72** : 293-317, bibl. 14.

In New South Wales two species of dark aphids, *Myzus persicae* and *Macrosiphum solanifolii*, were capable of transmitting the virus of woodiness disease to passion plants. Under experimental conditions the disease developed within 6 to 11 days after infective aphids had fed on healthy plants. It was shown that one aphid of either species could obtain the virus by feeding for 24 hours on a diseased passion plant and could transmit the disease after feeding on a healthy passion plant for the same length of time. Tests failed to show that insects other than aphids were capable of carrying the virus. Aphicidal measures, particularly among the seedling plants, are advocated.

102. HARRIS, R. V. 634.711-2.8
Mosaic disease of the raspberry in Great Britain.* II. Experiments in transmission and symptom analysis.
J. Pomol., 1940, **17** : 318-43, bibl. 21.

Successful methods of transmission of mosaic symptoms in raspberry by cleft grafting, patch grafting and cane inarching carried out at East Malling are described, transmission by mechanical means having previously given negative results. From the experiments thus made possible two symptoms have been provisionally referred to two distinct etiological categories, Mosaic 1 and Mosaic 2. Mosaic 1 expresses type by symptoms on the indicator variety Baumforth's B,

* For I, see *ibidem*, 1933, 11 : 237-55 ; *H.A.*, 3 : 488.

behaves as a single disease probably of single virus origin, is uniformly mild in expression and of comparatively limited varietal distribution. Mosaic 2 includes diseases expressing type C symptoms on Baumforth's B but differing in intensity of expression from mild to very severe. Mosaic 2 is widely distributed among local varieties and these show a wide range of susceptibility to injury. Thus Red Cross is totally infected but highly resistant, with an irregular expression of distinct leaf symptoms. No leaf symptoms have yet been expressed on artificially infected Lloyd George plants. Baumforth's B and Mitchell's Seedling are examples of susceptibles which are rapidly killed by severe Mosaic 2. Combined infection of Mosaic 1 and Mosaic 2 is frequent, e.g. the severe economic form of mosaic in Lloyd George consists of such joint infection. [From author's summary.]

103. BRANAS, J. 634.8-2.8
 Études effectuées sur le court-noué. (**Research on court-noué of vines.**)
Suppl. Progr. agric. vitic., 1939, vol. 111, No. 12, pp. 1-4, No. 14, pp. 5-8,
 No. 15, pp. 9-12, No. 16, pp. 13-16, No. 17, pp. 17-20, No. 18, pp. 21-4, No. 19,
 pp. 25-8.

A close examination of the results obtained in research on court-noué of vines in France and Germany. The conclusions reached are that court-noué is a virus disease spread by phylloxera and that strict sanitary measures are needed for its control and that any cultural methods tending to the spread of the insect must be discarded. This lengthy study, being inserted as a supplement with separate pagination, can be removed from the journal for binding or filing. The great interest now being taken in this disease is due to its sudden increase in nearly all districts of France.

104. BRANAS, J. 634.8-2.8-1.541.12
 Choix des greffons et court-noué. (**Choice of graft wood and court-noué.**)
Progr. agric. vitic., 1939, 111 : 3-8.

In selecting during winter material for grafting vines it is essential to avoid wood which is affected with court-noué. Badly attacked plants are obvious but vines in the early stages of infection are not easily distinguished. It is, however, a sound rule always to discard any shoots which have buds apparently opposite or nearly so, since these are really fasciations. Such wood is often actually selected for grafting under the impression that if one bud fails the other will grow. Branching wood where the branch has started opposite a bud should also not be selected. The malady is so universal in some districts that it may be difficult to get unaffected wood locally. Wood must thus be obtained from uninfected plants elsewhere. These are often to be found on sandy soil near the coast, or among very old vines which have always been annually submerged. Generally speaking, other things being equal, the old vines are always less affected with court-noué than the more recently planted. The undesirable types of wood are illustrated.

105. BRANAS, J., BERNON, G., AND LEVADOUX, L. 634.8-2.8
 Sur les circonstances qui favorisent le développement du court-noué. (**Factors encouraging court-noué of vines.**)
Progr. agric. vitic., 1939, 111 : 161-5.

No vine rootstock is immune to court-noué nor is there any purchasable remedy. Factors which appear to increase the disease are winter cultivation of the soil especially deep cultivation, sub-soiling between the rows especially on land which is usually only lightly cultivated, and immediate replanting of old vineyards without a rotational crop intervening. An interval of 4 years before replanting is advised and every vine root should be dug out no matter what its depth. It should be remarked that the authors assume that court-noué is a virus disease spread by phylloxera. Marsais and Segal (abstract 106) deny this and claim that it is of fungal origin ; in any case the methods for its restriction remain the same, being supported by numerous unassociated observations over many years.

106. MARSAIS, P., AND SEGAL, L. 634.8-2.8
 Le court-noué contagieux a-t-il les caractères d'une maladie à virus ? I and II. (Is court-noué of vines a virus disease ?)
Rev. Vitic., Paris, 1939, 46 : 257-64, bibl. 9, and 46 : 333-7.

I. The nature of virus diseases and the part played in their transmission is discussed and the work of certain writers who consider court-noué to be a virus spread by phylloxera is reviewed. The authors conclude that the evidence is not sufficiently strong to associate court-noué with virus and point out that the evidence for a fungal origin is much clearer.
 II. The argument is briefly restated with further emphasis in answer to an anonymous objector in another periodical.*

107. STAPP, C., MÜLLER, H., AND DANE, F. 632.314 : 634.1/8
 Der Pflanzenkrebs und sein Erreger *Pseudomonas tumefaciens*. VII Mitteilung. Untersuchungen über die Möglichkeit einer wirksamen Bekämpfung an Kernobstgehölzen. Crown gall, 7th Report. Investigations on the possibility of effective control in pome fruit trees.)
Zbl. Bakt. Abt. II, 1938, 99 : 210-76, bibl. 83.

This is a description of attempts made to find a better method of combating crown gall in the orchard than that hitherto used in Germany, namely, dipping the cleaned plants in an Uspulun bath immediately before planting out. It was found that *Pseudomonas tumefaciens* is capable of moving from its focus of infection in the healthy part of the host plant, which means that the removal of what appears to be the infected part is not likely to prevent a later outbreak of the trouble in the affected and treated plant. Attempts to control its incidence by the application of smaller amounts of N and larger amounts of P and K than usual were unsuccessful. Biological control consisting of treatment with non-virulent cultures was unsuccessful in the field. As substitutes for Uspulun 1%, Ceresan-Nassbeize produced excellent results, in fact better than did Uspulun-Saatbeize which may do damage in 2% concentrations. Badly infected soils should not be used for nursery stock, since the only remedy which proved effective in such cases was HgCl₂ at 15-20 g. per square metre, a substance which is both extremely poisonous and difficult to get. Soil disinfection with 50-100 g. sulphur per square metre combined with dipping in Ceresan, Uspulun or Abavit mixture was found useful on not too badly infected soil.

108. KIENHOLZ, J. R. 632.4 : 634.11
 Comparative study of the apple anthracnose and perennial canker fungi.
J. agric. Res., 1939, 59 : 635-65, bibl. 42.

A comparison is made of the effects on the tree and growth in culture of two closely related fungi native to the Pacific Northwest, namely, apple anthracnose, *Neofabraea malicorticis* (Cordley, Jackson, and perennial canker, *Gloeosporium perennans* Zeller and Childs.

109. HOLZ, W. 632.43 : 634.11 + 634.13
 Untersuchungen über die Biologie von *Fusicladium dendriticum* und *pirinum* in den Jahren 1936-1938 als Grundlage für die Bekämpfung (1).² (Biological studies of apple and pear scab in 1936-38.)
Forschungsdienst, 1939, 8 : 417-25, bibl. 31.

This is a comprehensive review of the last three years' literature on the biology of *Fusicladium* (*Venturia inaequalis* and *V. pirina*). There is still much work to be done, but it appears that there is already a sound basis on which to build a practical control system. The more important results may be summed up as follows:—On the basis of shape and colour a systematic classification has been made of the different *Venturia* types. In some pear-growing districts in addition to the basic types, certain other types were found. Particular populations were not necessarily limited to particular hosts. As regards the choice of host *Venturia inaequalis* was found to have

* *Progr. agric. vitic.*, 1939, 112 : 337-9.

² From the Biologische Reichsanstalt für Land- und Forstwirtschaft, State Branch of the Department.

physiologically specialized races. The chief obstacle in breeding scab-resistant apple varieties is the difficulty of obtaining pure perithecia cultures. *Venturia inaequalis* is regarded as a heterothallic fungus. Studies of the perithecia formation in the open showed that light was extremely important for the orientation of the perithecial neck in the leaf. Work on the effect of temperature and humidity in winter on perithecia development is not yet finished, but low temperatures were found to favour the formation of perithecia, while higher temperatures hastened the ripening of them. Several methods have been worked out for determining mass flight of spores. There was some evidence that in addition to ascospores conidia might come in spring from scabby branches. This was particularly characteristic of certain varieties. On account of the early development of these conidia, earlier sprays are thought to be advisable. Some progress has been made in investigations of the infection processes as for example by Holz with his *Fusicladium* dye method in 1936. Microscopic examinations of leaves of some resistant apple varieties showed that the mycelium could grow, but that the development of conidia took place only in a very few cases. Susceptibility to scab was found to increase with nitrogenous manuring and to decrease with increased dressings of potash.

110. ANON. 632.42 : 634.11 + 634.13

Le tavelure du pommier et du poirier. (Apple and pear scab (*Venturia inaequalis* and *V. pirina*).)

Memento Déf. Vég. Rabat 21, 1939, pp. 12.

This is a short practical account of apple and particularly pear scab and its control for the fruit grower in Morocco. It is noted that protection from rain afforded by screen or wall does much to prevent scab infection in espalier grown trees. Some 86 pear varieties are placed in one of five classes according to their degree of resistance to scab under French conditions. Control measures recommended comprise spraying with bordeaux or lime-sulphur and dusting with sulphur. When possible the treatment should be combined with that for codling moth.

111. DEY, P. K., AND SINGH, U. B. 634.11-2.4

The stem-black disease of apple in Kumaun.

Indian J. agric. Sci., 1939, 9 : 703-10, bibl. 6.

An investigation of the stem-black disease of apples (*Coniothecium chromatoporum* Corda) occurring extensively in Kumaun, United Provinces. The work was carried out at the Government Fruit Research Station, Chaubattia, U.P. Effective control measures are the painting of pruned or wounded surfaces with a paste consisting of 2 oz. each of red lead and copper carbonate to 100 c.c. raw linseed oil.

112. MEHTA, P. R. 634.11-2.4

A fruit rot of apples caused by a species of *Rhizopus*.

Indian J. agric. Sci., 1939, 9 : 711-18, bibl. 11.

A fungus which caused rotting on samples of apples attacked by codling moth is identified as *Rhizopus arrhizus* Fischer. Infection experiments are described. The work was done at the Imperial Agricultural Research Institute, New Delhi.

113. SHAW, L. 634.75-2.4

Control of leaf spot and scorch of strawberries.

Ext. Circ. N.C. agric. Exp. Stat. 236, 1939, pp. 8.

Descriptions are here given of two strawberry diseases, namely, leaf spot, caused by *Mycosphaerella fragariae*, and scorch, caused by *Diplocarpon Earliana*. Suggestions for their control under North Carolina conditions are made, consisting essentially of sanitation, transplanting disease-free plants, and spraying with 4-4-50 bordeaux mixture.

114. PETRI, L. 634.532-2.4
 Il mal dell'inchostro del castagno. (**The ink disease of the Spanish chestnut.**)
Ital. agric., 1938, **75** : 527-32.

The serious nature and spread of this chestnut disease [for its occurrence in France see *H.A.*, 7 : 72.—ED.] has led the Italian Ministry of Agriculture to require the compulsory notification followed by destruction of the tree and disinfection of the area occupied. This removes the evil but does not encourage chestnut growing. The present author urges the necessity for planned investigations with the resistant Japanese chestnut (*Castanea crenata*) and its use not only as a rootstock but also as a direct producer after appropriate hybridization. It is suggested that the Tamba variety of Japanese chestnut offers the greatest possibilities.

115. OLTARZHEVSKY, N. P. 632.411 : 634.8
Determination of minimum critical temperature for the appearance of mildew on vines. [Russian.]
Proc. Lenin. Acad. agric. Sci., 1939, **16** : 31-4, bibl. 20.

A review mainly of Russian literature on vine mildew, *Plasmopara viticola*.

116. DU TOIT, M. S., AND REYNEKE, J. 634.872-2.19
Dry stalk in table grapes, its causes and control.
Sci. Bull. Dep. Agric. S. Afr. **191**, 1939, pp. 20, bibl. 7.

(1) Dry stalk in export grapes is closely related to atmospheric humidity, especially after picking and during transit. (2) Wastage of berries varies inversely with dry stalk ; the more humid the atmosphere the greater the waste. (3) Growth and certain cultural factors affect the moisture content of the stalk and the subsequent development of dry stalk. (4) Wilting of bunches and dry stalk development usually start at the tip of the bunch and pedicel end of the berry. (5) The more vigorous the shoot the more compact was the bunch and the greater the moisture content of the stalk. (6) The beneficial effect of compactness is probably largely associated with the shielding effect of the berries. (7) Conditions of low humidity subsequent to picking and during transport can have a dominant influence on the moisture content of the stalk and may completely neutralize the beneficial results of sound cultural practice. (8) Cultural practice and the manner in which the grapes are handled before and after picking are extremely important. (9) The most satisfactory degree of humidity within the box was obtained by lining the box with waxed crystalline wrappers and including a small quantity of potassium meta-bisulphite in the packing. [From authors' summary.]

117. DU PLESSIS, S. J., AND REYNEKE, J. 632.482.1 : 634.872
Experiments on the control of dry stalk and wastage* in export grapes.
Sci. Bull. Dep. Agric. S. Afr. **195**, 1939, pp. 25, bibl. 9, being *Stellenbosch-Elsenburg Science Series* **36**.

The results of South African experiments on different varieties of grapes grown at Paarl, Stellenbosch and Constantia have led to the following conclusions:—Dry stalk may be reduced by wetting the wood-wool during storage, by lining boxes with waxed paper or enclosing individual bunches in waxed paper. The above methods of reducing dry stalk resulted in an increase of wastage, especially *Botrytis* rot, during storage. Of the large number of pre-storage treatments that might reduce rot and improve the stalk condition the following appeared to be promising:—Potassium metabisulphite as dry powder or in solution, alcohol at 48-96% strength, formalin at 6% (aqueous formaldehyde solution), formaldehyde fumigation.

118. DU PLESSIS, S. J. 634.872-2.482 : 664.85.8
A comparison of the effectiveness of various fungicides and the methods of their application for the control of *Botrytis* rot of grapes.
Sci. Bull. Dep. Agric. S. Afr. **199**, 1939, pp. 29, bibl. 6.

Experiments on vineyard treatments conducted during the 1936-7 season indicated that Verderame sulphur dust (80 : 20 resp.) was definitely more effective for the control of grape wastage

* See also 345-348.

than Folosan. Previous results were confirmed, namely, that it appears to be hardly profitable to apply this dust more than once to grapes in the vineyard. The results of a dusting and spraying experiment during the 1937-8 season indicated that Verderame sulphur dust is a more effective fungicide than any of the other fungicides tested, viz. cuprous oxide spray, Shirlan AG spray, Shirlan WS spray, cuprous oxide sulphur dust (80 : 20 resp.) and cuprous oxide spray followed by Shirlan AG spray. The latter appeared to be the most promising of the new fungicides tested against *Botrytis* rot of grapes. The necessity of moderate applications of fungicides to grapes was clearly evident during these experiments and this precaution is particularly stressed to avoid possible spoilage of grapes through these treatments. Several experiments to test the comparative value of Verderame sulphur dust, or Folosan dust in the vineyard and the formaldehyde prestorage treatments of grapes, showed that, if properly applied, the effect of the latter treatments practically overshadowed that of the vineyard treatments. To guard against possible outbreaks of *Botrytis* in the vineyard, it is nevertheless regarded a safe practice to apply Verderame sulphur dust moderately to grapes in the vineyard. The results of experiments for testing different chemicals for prestorage applications show that the formaldehyde treatments still appear to be the most promising, while ammonium bicarbonate also showed promise of reducing *Botrytis* rot. Attention was furthermore drawn to another contribution where it is concluded that potassium metabisulphite applied as a solution, or as crystals or in the form of an alcohol suspension may definitely be recommended, especially for areas troubled with the so-called "dry stalk" condition of grapes. It was found that also alcohol added at concentrations of 48% or 96% to the wood-wool linings of boxes at the rate of 10 c.c. per box reduces *Botrytis* rot considerably. The quantity of grapes in the fumigation chamber affected the injurious effect of formaldehyde gas on grapes slightly, smaller quantities apparently favouring injury, but also increasing its effectiveness. The temperature of the chamber during fumigation was found to affect especially the injuriousness of formaldehyde gas to grapes considerably. Temperatures above 25° C. appeared to be absolutely unsafe for fumigation of grapes. Presumably the same will hold true for spraying the linings of boxes with an aqueous solution of formaldehyde. Generally lower temperatures at the time of these treatments will favour excellent results. Post-storage temperatures affect the beneficial effect of formaldehyde for wastage control, its optimum action being recorded when the grapes are stored at 45° F. after cold storage. The injuriousness of the gas, however, seems to increase with increase in temperature. [Author's summary.]

119. GINAI, M. A. 634.8-2.482

A note on *Botrytis*-rot of grapes in the Quetta Valley.

Indian J. agric. Sci., 1939, **9** : 719-25, bibl. 26.

A rot of grapes due to *Botrytis vulgaris* Fr. is recorded from the Fruit Experiment Station, Quetta. The life history of the fungus in the laboratory and in the field is described.

120. THOMPSON, W. R. 632.963

Some beneficial insects.

Bull. Minist. Agric., Lond. **20** (4th edit.), 1939, pp. 26, 9d.

The life histories, some of them truly remarkable, of beneficial predacious and parasitic British insects are briefly described. This, the 4th edition, has been entirely rewritten, though the excellent coloured plates of previous editions have been retained.

121. WORTHLEY, H. N., AND STEINER, H. M. 634.11-2.7

Apple insect control studies in 1938.

Bull. Pa agric. Exp. Stat. **376**, 1939, pp. 13.

In 1938 experiments in Pennsylvania good aphid control was obtained with tar oil and certain other toxicants added to dormant petroleum oil sprays, and with nicotine sulphate added to delayed dormant sprays of liquid lime-sulphur or petroleum oil. None of the spray mixtures tested proved satisfactory against winter eggs of European red mite (*Paratetranychus pilosus*). Lead arsenate gave the best control of codling moth, but lead residue after such treatment

exceeded the present tolerance limit. The addition of stickers to lead arsenate in four cover sprays did not result in increased control. A high degree of codling moth control and reduced spray injury was obtained by producing a heavy lead arsenate deposit in the second and final cover spray through the use of an inverted or "dynamite" spray mixture. The omission of lime-sulphur from the cover spray mixture resulted in a great increase in arsenic injury to the foliage, while the use of copper phosphate fungicide in place of lime-sulphur seriously interfered with codling moth control. Pistol case bearer (*Coleophora malivorella*) control was best secured with two sprays containing 75% summer oil and nicotine sulphate at the rate of 1 pint per 100 gallons applied in early July against the eggs and young larvae.

122. FIKRY, A.

634.2-2.651.3 : 631.541.11

Nematode disease of stone-fruits.*Bull. Minist. Agric. Egypt* 217, 1939, pp. 9, bibl. 2.

The distribution, severity of attack in Egypt and the identification of the eelworm that causes the root-knot disease of stone fruit trees are described. Apricot, Marianna and Myrobolan plum rootstocks have been found immune to root-knot disease, *Prunus Davidiana* resistant, and beladi peach and almond rootstocks highly susceptible. It has been found that *Prunus Davidiana*, almond and beladi peach are completely compatible to peach scions, apricot incompletely compatible while Marianna plum rootstock is completely incompatible. *Prunus Davidiana* rootstock influences the general vegetative growth, vigour, size and the productive capacity of certain peach varieties more favourably than beladi peach or apricot rootstock. The most practical control measure from the point of view of root-knot and other horticultural considerations is to grow the nematode resistant stocks, namely *Prunus Davidiana* for peaches or Marianna for plums and apricot for apricots. [Author's summary.]

123. HILDEBRAND, A. A.

634.75-2.752-2.8

Notes on mealy bug injury on strawberry and its resemblance to crinkle.*Canad. J. Res.*, 1939, 17, Sec. C, pp. 205-11, bibl. 9, being *Contr. Div. Bot.**Plant Path. Dep. Agric. Ottawa*, 586.

The similarity between the symptoms caused by the attacks of mealy bugs (*Pseudococcus* spp.) on strawberry plants grown under glass and those of the virus disease known as crinkle is discussed. The symptoms common to both troubles take the form of small translucent spots with more intensely chlorotic central portions, and unevenly chlorotic character and general malformation of the older leaves and an ultimate general dwarfing of heavily infested plants. The injuries are illustrated by photographs.

124. GREENSLADE, R. M., AND PEARCE, S. G.

632.753 : 634.75

Field sampling for the comparison of infestations of strawberry crops by the aphid *Capitophorus fragariae* Theob.*J. Pomol.*, 1940, 17 : 308-17, bibl. 5.

An account is given of a search for a method of sampling the population of *Capitophorus fragariae* Theob. in strawberry fields. The method devised consists of counting the aphides on a number of sample leaves, one leaf being taken from each of a number of equal-sized blocks into which the field is divided. It is shown that the quantity $\sqrt{n + \frac{1}{2}}$, in place of the actual number of aphides on a leaf, n , enables considerably better comparison to be made between different samples. Evidence is advanced to show that the standard deviation of $\sqrt{n + \frac{1}{2}}$ within a block of less than 500 plants rarely exceeds 1.3. [Authors' summary.]

125. MINISTRY OF AGRICULTURE, LONDON.

632.95 : 634.1/7

Better fruit : disease control in private gardens.*Growmore Leaflet*, 9, 1939, pp. 7.

Useful suggestions are made to enable the private gardener to make the most of his home-grown fruit. Elementary spraying operations are outlined for the protection of the following fruits :—

Apples and pears ; plums and damsons ; blackcurrants and gooseberries ; raspberries. A list is included of leaflets giving supplementary advice on particular points.

126. WILLISON, R. S. 634.25-2.95

Fall spray injury to peach trees.

Sci. Agric., 1939, 19 : 670-2, bibl. 2, being *Contr. Div. Bot. Plant Path. Dep.*

Agric. Ottawa, 595.

When injury from the autumn spraying of peach trees with lime-sulphur occurs it will be found that the leaf scar with its leaf traces is one of the main avenues of penetration. The injury is infrequent and depends on the thickness of the so-called protective layer and possibly upon the density or quantity of the decomposition product in that region. Such factors are affected by environmental and cultural conditions. Whether the toxic action of the lime-sulphur or some indirect effect is responsible for the injury is not known.

127. PHILLIPS, E. P. 632.51

The weeds of South Africa.

Bull. Dep. Agric. S. Afr. 195, 1938, pp. 229, 1s.

This is an illustrated description containing 149 full-page text figures of South African weeds. It contains a key to weeds, a plant index and a glossary of technical terms used to describe leaf characters.

128. PERLBERGER, J. 634.13-2.4

***Entomosporium maculatum* on pears.**

Pal. J. Bot. (R.), 1939, 2 : 289-91.

Occurrence on leaves of pears worked on *Pyrus syriaca*.

IBATULINA, F. S.

632.76 : 634.1/8

Experiments on weevil control in the orchard. [Russian.]

Plant Protection, Leningrad, 1939, No. 19, pp. 74-92, bibl. 19.

VEGETABLE GROWING, STIMULANTS.

129. REINHOLD, J. 635.1/7 : 631.521

Zuchtziele im Gemüsebau.* (The aims of vegetable breeding in Germany.)

Forschungsdienst, 1939, 8 : 287-98, bibl. 17.

Very briefly the main aims of a German vegetable breeder are as follows :—*Cabbage* (including red cabbage). Firm, finely ribbed, heavy heads. Colour of head and shape and size of the stalk are also important. *Cauliflower*. Varieties are wanted with protective shading leaves to prevent bleaching of the flower. In other *Brassicæ* firmness and frost hardness are particularly demanded. *Spinach*. Frost resistance and high yielding capacity are the chief aims. *Lettuce*. The aim of forcing lettuce breeders is better resistance to *Bremia Lactucae*. Improved resistance of all types of lettuce is being sought to non-parasitic leaf-scald. *Asparagus*. Early cropping, high yields and resistance to *Puccinia* and *Fusarium* wilts are the chief aims. *Rhubarb*. A variety is wanted that will combine the characters of high yield, medium acidity and red flesh. *Onions*. Breeding for better storage capacity and higher content in essential oils and sugars. *Leeks* should have greater hardness. *Carrots* should produce higher yields and ripen early while late varieties should be capable of long storage. *Parsley*. Varieties are needed that could be grown both for use as roots and herbs. *Celery* [actually celeriac.—ED.]. Breeding aims at good root formation and resistance to *Septoria* rot. *Beetroot* breeding is for improvement in colour, shape and storage capacity. *Beans*. Non-fibrous pods and a white interior of the bean are

* Report of the Arbeitskreis IV/1. Vegetable breeding. A lecture given on the 15th Aug., 1939, at a meeting of the Reichsgemeinschaft Gartenbau des Forschungsdienstes in Hohenheim.

the main objects. *Peas* should possess good canning properties. As regards *cucumber* breeding, resistance to certain diseases and improvement of storage capacity are important. Varietal studies should be combined with soil studies. In *melons* improvement in flavour is desired. There is a demand for well-shaped, round *gourds* lacking the runner habit. *Tomatoes* with many seed receptacles are preferable to those with fewer on account of their larger amount of fruit flesh.

130. LAPTEV, I. I. 633.42-1.531.17
Artificial drying as affecting the germinating capacity of certain vegetable seed. [Russian.]

Vegetable Growing, Moscow, 1939, No. 7, pp. 46-7.

Drying under controlled conditions did not improve the viability and germinating capacity of turnip seed sown two years after drying.

131. KHASHBA, L. KH. 635.1/7 : 631.531.17
Artificial drying of stalks of plants left to run to seed. [Russian.]

Vegetable Growing, Moscow, 1939, No. 7, p. 45.

Drying the seed of certain vegetables under controlled conditions considerably increased its viability and germinating capacity. Optimum drying temperatures and lengths of treatments are recommended as follows:—chicory at 45-50° C. for 4 hours; lettuce at 60-65° for 2½ hours; spinach at 50-55° for 3½ hours; cabbage at 40-45° for 5 hours, and beetroot at 50-55° for 3½ hours.

132. REISSLER, YU. V. 631.3 : 631.531.2
Agricultural machinery at the Moscow agricultural exhibition. [Russian.]

Vegetable Growing, Moscow, 1939, No. 9, pp. 3-6.

Among other types of newly designed machinery to be used by the State and collective farms in U.S.S.R. for the production of potatoes and other vegetables, a machine intended for planting cabbage, tomato and other vegetable seedlings appears to be particularly useful. The R P O manufactured by the Ryazsel'mash and driven by U-2 tractor not only makes a furrow and plants the seedlings but waters them and presses the soil firmly round them. Seedlings of over 15 cm. can be used.

133. BENEDIKTOVA, E. 635.1/7.
Vegetables grown in the open air at the Moscow agricultural exhibition. [Russian.]

Vegetable Growing, Moscow, 1939, No. 8, pp. 5-11.

The open-air vegetable plots present among others the following points of interest:—(1) Onions producing higher yields on account of compost and peat mulching. (2) Certain tomato hybrids that were early-ripe and produced higher yields than their parents. (3) Drought and disease resistant cucumbers. (4) Among many new and improved varieties of vegetables of all descriptions there were certain wild Far Eastern onions containing large amounts of vitamin C, while sheep's sorrel, which is elsewhere known only as a weed, was grown for its vitamin A content. The cultivation of the latter is said to be easy and plantations under sorrel may be maintained for 3-4 years.

134. BYKOVSKY, V. YA. 635.1/7 : 551.566.3
Vegetable growing in the extreme north of Russia. [Russian.]

Lenin Academy of Agricultural Sciences, Leningrad, 1936, pp. 80.

The object of this booklet is to outline the special features of vegetable growing in the arctic and non-arctic regions of the northern part of European and Asiatic continental Russia, and to make certain recommendations as to what vegetables should be grown there. A reader expecting to be informed mainly about vegetable growing under glass will be surprised to find an even longer chapter dealing with open-air cultivation. The vegetables are the ordinary north European ones.

135. THOMAS, W., AND MACK, W. B. 631.8:633.491
Foliar diagnosis : physiological balance between the bases, lime, magnesia and potash.

Plant Physiol., 1939, 14 : 699-715, bibl. 13.

Experimental material consisted of maize and the potato plant.

136. THOMAS, W., AND MACK, W. B. 633.491-1.8
Foliar diagnosis : the influence of the soil on the action of fertilizers.
Plant Physiol., 1939, 14 : 75-92, bibl. 8.

The successful application of foliar diagnosis to the examination of the influence of soil on fertilizer action in potato plants growing on (1) a homogeneous and (2) a heterogeneous soil.

137. CAMERON, A. E. 633.491-2.64
The control of potato slugs.
J. Minist. Agric., Lond., 1939, 46 : 454-62.

The grey field slug (*Agriolimax agrestis*) and others attacking potatoes in the Lothians, Scotland, was successfully controlled by the application to the field of meta mixed with bran $\frac{1}{2}$ lb. to 25 lb. in the middle of September just before the "shaws" wither, at the rate of 25 lb. per acre. Three or four treatments at fortnightly intervals are recommended, the cost being at the rate of 5s. per acre. After the potatoes are lifted the slugs wander to the adjacent stubble fields which have been heavily dunged in preparation for next year's potato crop. These fields therefore should also be treated. The number of slugs killed in local experimental plots per acre was from 12,000 to 14,000. A heavily manured turnip plot gave a kill of 96,000 slugs per acre.

138. REDGROVE, H. S. 633.75
Why neglect poppy seeds for bakery and confectionery ?
Food Manuf., 1939, 14 : 1 : 24.

The greater use of poppy seeds in confectionery is urged. Methods of use are suggested. The seeds have an agreeable nutty flavour and are highly nutritious owing to their high content, 44-50% or more, of a bland fixed oil of which an analysis is quoted. It is pointed out that the seeds, contrary to popular belief, do not contain opium.

139. STÁDNÍK, J., AND KATĚTOV, V. (Editors). 633.859
 Srovnávací pokusy s mákem v letech 1933-1937. (**Comparative trials with poppies, 1933-37.**)
 Reprinted from *Zem. Arch.*, 1939, 30, No. 1-2, pp. 8.

Comparative study of poppies carried on for several years showed that the per ha. yields were higher in Bohemia than in Moravia, where they were reduced by pests. Grey poppies of Bohemian origin yielded more highly in Bohemia than in Moravia, while blue poppy varieties of Moravian origin showed preference for that part of the country. The grey varieties Dubský and Freudlův contained the largest amounts of oil.

140. COCHRAN, H. L. 633.842
Growth and distribution of roots of the Perfection pimiento in Georgia.
J. agric. Res., 1939, 59 : 185-97, bibl. 4.

The mild flavoured pepper, pimiento (*Capsicum frutescens* L. var. *grossum* Bailey), is one of the most important vegetable canning crops grown in Georgia. The investigations reported here are preliminary to fertilizer trials. It was found that, subjected to the normal practice of germination in hot bed and transfer to the field at about 2 months, the plant forms roots which, 60 days after transplanting, will completely occupy the soil on all sides of it to a depth of 10-14 inches. By the end of August the larger roots will have extended outwards 40 inches from the base and down as deep as 26 inches. Mature or 8-month-plants have a root spread of 48-52 inches on each side.

141. RITCHIE, T. F. 635.126
Rutabaga or swede turnip as a vegetable crop.
Publ. Dep. Agric. Canada 647, 1939, pp. 4, being *Circ.* 142.

The following essential points in the cultivation of the swede turnip (*Brassica Napobrassica*) are here discussed; soils and management; drainage; manure and fertilizer; lime; brown-heart; methods of seeding; seed, varieties and seeding; cultivation, hoeing and thinning; insects; diseases; harvesting; grading; waxing and transplanting.

142. WOODMAN, R. M. 631.8 : 635.13 + 635.25 + 635.15
The effects of a deficiency of certain essential elements on the development and yield of carrots, onions and radishes grown in sand cultures under glass.
J. Pomol., 1940, 17 : 297-307, bibl. 6.

Lack of potassium produces a general tendency to scorch and wilt of portions of the tops of the plants. Very little potassium seemed necessary for good growth under the conditions of the experiment but deficiencies of nitrogen and phosphorus gave greatly diminished yields. In onions deficiency of nitrogen produced pale green tops and in radishes a characteristic red outline of the cotyledons occurred including also the central veins. Reductions in yield with solutions containing only small amounts of potassium, calcium, and magnesium were much smaller. The studies were carried out at the Horticultural Research Station, Cambridge University.

143. KRICKL, M. 635.25 : 631.521
Neue Zuchtziele bei Küchenzwiebel im Hinblick auf die Marktversorgung.
(New aims in onion breeding in Germany.)
Züchter, 1939, 11 : 321-4, bibl. 3.

The chief aim is to produce a variety which will be ready for market later and will not lose too much weight on storing. There would appear to be ample material from which to select and breed with these aims in view.

144. JONES, H. A., AND EMSWELLER, S. L. 635.25 : 631.531
Effect of storage, bulb size, spacing and time of planting on production of onion seed.
Bull. Calif. agric. Exp. Stat. 628, 1939, pp. 14, bibl. 3.

The best temperature at which to store mother bulbs of a highly non-bolting strain of Ebenezer was about 53·5° F. Plants from bulbs stored at this temperature bloomed and ripened their seed earlier, produced more seed stems and yielded more seed per acre than plants from mother bulbs stored at higher or lower temperatures. In a comparison of eight different sizes of mother bulbs of the Yellow Globe Danvers variety, ranging in weight from about 15 to 90 grams, there was found to be an increase in number of seed heads per plant, in seed yield per plant, and in seed yield per acre with each increase in size of bulb. In spacing tests with the Yellow Globe Danvers variety, bulbs were set 3, 4, 6, 8 and 12 inches apart in a row. A significant increase in seed yield per plant was secured with each increase in spacing but a decrease in yield of seed per acre. When bulbs of Yellow Globe Danvers were planted at different dates throughout the winter there was a delay in time of seed maturity of the late-planted bulbs; and, accompanying this, a decrease in yield of seed. [Authors' summary.]

145. MCKAY, R. 635.25 : 632.4
Observations on onion mildew caused by the fungus *Peronospora Schleideniana* W. G. Sm.
J. roy. hort. Soc., 1939, 64 : 272-85, bibl. 10.

Although it is often recommended that onions should not be planted for 3 years on land that has borne a mildew-diseased crop, facts are presented in this paper to show that the greater danger is to be apprehended from oospores after 3 years rather than sooner. The method of infection of the host plants by the oospores or their products is still obscure.

146. CULPEPPER, C. W., AND MOON, H. H. 635.31
Changes in the composition and rate of growth along the developing stem of asparagus.

Plant Physiol., 1939, **14**: 677-98, bibl. 14.

In these experiments on field grown asparagus at Arlington, Virginia, the rate of elongation of stem on different zones was determined for plants of different heights at temperatures between 65° and 70° F. The rates were found to vary characteristically for each height of stalk, e.g. the zone of maximum growth changes its position relative to the tip with each height of stalk. Again analysis of stalk segments at different heights shows that the total solids vary greatly at different points along the stalk. Total sugars are highest at the base and decrease rapidly to a low value near the tip. Total nitrogen is lowest at the base and increases rapidly in regions near the tip. Changes in total astringency are very closely correlated with changes in total nitrogen. It is lowest towards the base and highest at the tip.

147. CULPEPPER, C. W., AND MOON, H. H. 635.31 : 551.52
Effect of temperature upon the rate of elongation of the stems of asparagus grown under field conditions.

Plant Physiol., 1939, **14**: 255-70, bibl. 12.

For temperatures between 52·5° and 87·5° F. the relationship between growth rate and temperature in these experiments at the Arlington Experiment Farm, Va, is represented by lines which are almost straight. The rate of total elongation approximately doubled with each increase of 18° F. over a limited range of temperatures. A consideration of the data shows that, if it is wanted to cut asparagus between the heights of 10 and 25 cm., cutting would have to be done every 5·3 days with an average temperature of 52·5° F., every 4·2 days with an average of 57·5° F. . . . and every 2·1 days with an average of 72·5° F.

148. AGATI, J. A., AND RODRIGO, P. A. 635.34 : 631.8
Pot culture experiments on cabbage.

Philipp. J. Agric., 1939, **10**: 295-301, bibl. 6.

Pot manurial experiments carried out by the Philippine Bureau of Plant Industry are described. NP and NK respectively gave better results than N alone and generally the best results were obtained from a complete NPK. The yields did not always increase proportionately with the rates of application of fertilizers. The results are considered as a fair index for future tests in the field.

149. RICHARDS, M. C. 635.41 : 632.411.4
Downy mildew of spinach and its control.

Bull. Cornell agric. Exp. Stat. **718**, 1939, pp. 29, bibl. 58.

For several years spinach mildew and its control have been studied in Nassau County, New York. The host range of the pathogen, *Peronospora Spinaciae* Laubert, is thought to be limited to the members of the genus *Spinacia*. Disease symptoms are yellowing, stunting and necrosis of the infected areas. Overwintering plants were found to be the main source of infection. Wind and rain were important inoculating agents. Neither the use of copper fungicides nor the selection of spinach varieties for resistance proved successful. The isolation of overwintering spinach plants from winter- and spring-sown crops is recommended.

150. TURNER, D. M. 635.48
The economic rhubarbs.

J. roy. hort. Soc., 1938, **63**: 355-70, bibl. 64.

An historical survey of the cultivation of the economic rhubarbs in Britain. The first to be cultivated in Europe was *Rheum Rhabonticum*, a native of the Volga basin. Although long employed in England medicinally it did not come to be employed in English cookery until the first half of the eighteenth century.

151. KOPETZ, L. M. 635.52
Strunkuntersuchungen an Kopfsalaten. (*Stalk investigations in cabbage lettuce.*)
Züchter, 1939, 11 : 277-9.

The author has examined the wedge-like stalks of a number of cabbage lettuce varieties and finds that those of different varieties have characteristic shapes. He gives illustrations of 5 sorts.

152. WOODMAN, R. M. 635.52 : 631.83
Studies in the nutrition of vegetables : the effect of varying the potash supply on sand cultures of lettuce.
Soil Sci., 1939, 48 : 101-8, bibl. 4.

An account in slightly different words of the experiment described in *J. Pomol.*, 1939, 17 : 167-80, *H.A.*, 9 : 911.

153. QUARRELL, C. P. 635.52 : 631.544
Early outdoor lettuces from plants raised in cold frames.
J. Minist. Agric., Lond., 1939, 46 : 539-46.

The lettuces treated as described in the paper are sown in October, or less successfully in January, under glass, pricked out or thinned, still under glass, soon after germination, planted in the field in February and March and marketed in May or June. Suitable varieties for the pricking out and for thinning without pricking-out systems are given.

154. THOMPSON, R. C., AND KOSAR, W. F. 635.52 : 631.53
Stimulation of germination of dormant lettuce seed by sulphur compounds.
Plant Physiol., 1939, 14 : 567-73, bibl. 17.

Of the six chemicals tested thiourea was found to be the most generally effective material for promoting the germination of dormant lettuce seed. In a 0.5% concentration it resulted in stimulation of germination in every lot of dormant seed submitted to treatment. In some cases it gave nearly 100% germination in seed which was completely dormant in water under the same conditions of temperature and light.

155. C., P. 635.55 : 631.544
Forçage électrique de l'endive (Chicorée Witloof). (Forcing chicory by electric heating.)
Rev. hort., Paris, 1939, 26 : 529-30.

A method of forcing chicory out of doors by underground electric heating is described. The point of interest is that even distribution of heat is obtained by running an electric heating cable through drain pipes previously placed in position under the beds. Forcing takes 15-20 days, after which the cables are withdrawn and used on a succession bed, or the same bed can be replanted with sets which are kept in the dark and cool until required, usually being stored in barrels. During forcing the beds and plants are covered with straw and corrugated iron.

156. FIKRY, A. 635.62 : 632.19 : 631.432
Water-table effects. IV. Relative incidence of diseases on cucurbits.
Bull. Minist. Agric. Egypt 221, 1939, pp. 9, bibl. 3.

High sub-soil water-table influenced the appearance, development and severity of attack of both powdery mildew and leaf spot of cucurbits. Both diseases appeared earlier, developed more rapidly and attacked plants more severely in low terrace lands than in the higher ones. Growth and yield of vegetable marrow and watermelon was greatly affected by high sub-soil water-table. Plants grown on land with high water-table were less vigorous and yielded significantly less than those grown on low water-table land. The physiological wilt of Baili watermelon was directly caused by high sub-soil water-table. Chilian Black-Seeded was more susceptible to wilt than certain other varieties.

157. CRANE, M. B. 635.64 : 575.114

Rogues and segregation in tomatoes.

Gdnrs' Chron., Lond., 1939, 105 : 92-3, 110-11, bibl. 2.

The appearance of rogue plants among the seedlings of certain tomato varieties is now attributed to unstable genes mutating in both directions and not, as was first thought, to chromosome aberration. The segregation of characters in the tomato is discussed. There is shown to be no truth in the popular notion that the part of the plant from which the fruit is taken for seed has any effect on the character of the resulting progeny. The origin of this misconception is traced.

158. ROZGON, K. N. 635.64 : 631.546 + 631.542

Methods of cultivation and care as affecting tomato yields. [Russian, German summary 5 lines.]

Proc. agric. Inst. Krasnodar, 1935, No. 3, pp. 139-45.

Trials in Kuban with tomatoes variety "King of the Earlies" led to the following conclusions:—

1. Tying the plants increases yields; 2. Pruning decreases total yields but increases the yields of early fruits.

159. KHAZINA, E. 631.541.11 : 635.64 + 635.646

Nightshade as a rootstock for tomatoes and egg-plants. [Russian.]

Vernalization, Moscow, 1939, No. 3 (24), pp. 44-9.

This is an illustrated description of trials in Odessa to introduce early ripening characters in various plants by grafting them to early-ripening stocks. *Tomatoes*. Grafting was done in the glasshouse in December, 1938. After vegetative shoots had been removed from the nightshade stock, which was then fruiting, it was split in the centre, and a tomato scion inserted in a manner giving the best contact of outside tissues (bark) of the stock and scion. The grafted material was tied with woollen thread and placed for 3-5 days under a bell jar to create a more humid atmosphere. The percentage of "take" was surprisingly high (nearly 100%). The only treatment the plants received beside the usual care was the removal of buds from the stock in order to increase scion vigour. The tomato varieties used were Humbert and Earliana. Both varieties had when worked on nightshade a more intensively coloured foliage and dark violet stems. At first grafted plants grew more vigorously than the controls. Later, however, the controls surpassed them in growth but lagged behind considerably as regards bud development, e.g. grafted Earliana plants started bud formation on 10 February 1939, while the control plants only started it on 15 March 1939. Grafted Humbert plants were similarly a month ahead of the controls. The first ripe fruits from grafted Humbert plants were obtained on 3 May 1939, and from grafted Earliana plants on 8 May. The fruits were of normal size and flavour. Trials with blue egg-plants on rather similar lines, largely confirmed the results of the experiments with tomatoes.

160. GUSTAFSON, F. G., AND HOUGHTALING, H. B. 635.64 : 631.542 : 581.192

Relation between fruit size and food supply in the tomato.

Plant Physiol., 1939, 14 : 321-32, bibl. 4.

Experiments by the authors in the grounds of the University of Michigan showed that by increasing the leaf area per fruit one can cause the individual fruits to grow much larger, but that there is a limit to the size of fruit produced, dependent on variety. Data are presented of the size of ovaries and of mature fruits and of the cell size of these ovaries and fruits, also of the diameter of the stem pith just below the insertion of the flower cluster, and finally of the number of locules in the fruits measured under different systems of pruning.

161. FISH, S. 635.64 : 632.3/8

Tomato diseases and their control.

J. Dep. Agric. Vict., 1939, 37 : 378-91, bibl. 8.

Nineteen diseases (including two pests, mite and eelworm) which affect the tomato are described and illustrated and control measures are suggested.

162. TAUBENHAUS, J. J., AND ALTSTATT, G. E. 635.64 : 632.19
Some factors contributing to tomato puffing.
Plant Physiol., 1939, 14 : 575-81, bibl. 25.

Tomatoes affected by puffing are light in weight, angular, flat-sided and more or less hollow. The studies here reported from Texas and elsewhere indicate that it is not due to micro-organism or virus. The condition is influenced by soil moisture and probably by certain fertilizers as well as by environment. Irrigated plants suffered worse than non-irrigated.

163. HYNES, H. J. 635.64 : 632.48
Control of tomato leaf mildew. Successful results in glasshouse tests.
Agric. Gaz. N.S.W., 1939, 50 : 244-7, pp. 4.

Leaf mildew, caused by the fungus *Cladosporium fulvum*, is one of the most serious glasshouse diseases of tomatoes in New South Wales. Of the various sprays and dusts studied Shirilan A.G. gave the best control. The result was that the picking period was extended by 3-4 weeks and the yields of fruit were substantially increased, i.e. 50% to 60% in most cases. The net profits, disregarding costs of labour for spraying, amounted to £20-£25 per standard house. The treatments should commence a few weeks after transplanting and be continued at fortnightly intervals for as long as practicable. It is essential to carry on spraying during the September-October period, when mildew normally is likely to develop rapidly. The strength of Shirilan for application at all growth stages should be 1½ lb. (1 pint) to 40 gallons of water. Best results will be obtained where high pressure spray pumps are employed.

164. EL-HELALY, A. F. 635.651 : 632.451 + 632.482
Further studies on the control of bean rust with some reference to the prevention of chocolate spot of beans.
Bull. Minist. Agric. Egypt 236, 1939, pp. 24, bibl. 6.

Spraying with ½% bordeaux mixture is considered the most efficient and economic method for controlling rust (*Uromyces Fabae*) and chocolate spot (*Botrytis* spp.) of beans in Egypt.

165. CHORIN, M. 635.651 : 632.482
The chocolate spot disease of beans (*Botrytis Fabae* Sard.).
Pal. J. Bot. (R.), 1939, 2 : 291-3.

166. ANON. 635.655
The soya bean : its importance as food.
Food Manuf., 1939, 14 : 59-61.

The soya bean is a source of twenty or more raw materials. It is not an economic crop in England, being purchasable at £7 a ton. It is recorded that in 1936 Great Britain imported soya beans to the value of £801,949, the whole of it from foreign countries and none from the Empire, £37,304 of refined soya bean oil from foreign countries and £12 worth from the Empire. It is suggested that to have so neglected a defensive resource of incalculable industrial value is unreasonable. The recognition of the value of the crop by the U.S.A. Government and the sedulous fostering of its cultivation by the U.S. Department of Agriculture is pointed out.

167. TULAIKOVA, K. P. 635.656 : 581.143.26.03
Vernalization trials with peas. [Russian.]
Vernalization, Moscow, 1939, No. 3 (24), pp. 98-103.

Experiments with peas carried out near Moscow for four years led to the following conclusions. The study of vernalization methods for pea varieties cannot be limited to laboratory trials, field data being essential. Vernalization of the pea variety Capital hastened the development by 5-9 days and increased the yields of shelled peas by 26%. The ordinary germination treatment cannot take the place of a proper vernalization. The best results followed treatment which included the use of water (80% in weight of dry seed), and a temperature of 10°-12° C. In this manner the peas were treated for 10 days.

168. HATTON, R. G., AND BEARD, F. H. 633.79
A report of hop research work at East Malling Research Station.
J. Inst. Brew., 1939, 45*: 556-9.

A brief account of recent hop research work at East Malling Research Station including varietal tests, cultural and manurial trials and a study of hop diseases. It may be noted that the station's collection of commercial varieties includes one strain of Fuggles which has given heavier yields and proved more frost-resistant than others. The mosaic-free Goldings show differences in season. A joint enquiry with Wye College into nettlehead disease is described and a note is given of progress in work on *Verticillium* wilt, another joint investigation.

169. ANON. 633.79-1.55
They're picking hops mechanically now.
Standard Oil Bull. Calif., Sept. 1938, pp. 11-3.

Of recent years many growers have found increasing difficulty in obtaining sufficient labour for their picking. This has led to considerable interest in the development of picking machines. Up to the present these have been of the stationary type, but it is obvious that a satisfactory portable type would have many advantages. The carting of bines to a central depot is of particular disadvantage where the gardens are rather scattered. A portable picker has now been developed by Mr. Edward Thys working in the machine shop at the Sacramento, U.S.A., hop ranch of Mr. Clemens Horst. Several of the machines were in use on the Sacramento ranch in the 1938 season. The machine is driven by a petrol engine and drawn by a tractor. A man walks in front of the machine and cuts off the bines at about 3 ft. from the ground. The bines are fed into the machine by two men standing on a platform in front, over the tractor driver's head. The cones are detached from the bines by means of V-shaped wire fingers. The picked hops are then conveyed by means of a bucket belt on to a separate belt running over one upper and two lower drums, where the leaves are removed by means of combined suction and draught created by two fans. This still leaves the small lateral bines which are then removed by a revolving brush operating over another bucket belt. The hops are finally delivered *upwards* into a hopper by means of a powerful draught, thus preventing the passage of stones, clods, etc., with the hops. The hopper discharges by gravity into the pokes. The machine will pick about 2 acres in a ten-hour day. It should be quite suitable for use in gardens with the "umbrella" or similar type of training. The "Butcher" system of training with its restrictions on free movement is ill adapted for use with either portable or stationary machines. [As American hops have more petals and are of a firmer nature, it may be necessary to make some modification in the machine to adapt it for use with the English varieties with their less robust cones.—Abstractor.]
F.H.B.

170. BRIEN, R. M. 633.79-2.411
Black root-rot of hops.
N.Z. J. Sci. Tech., 1938, 20: 62A-4A, reprinted as *Bull. Plant Diseases Div.*
D.S.I.R., N.Z. 11.

It has been demonstrated that black root-rot, a disease of hops in the Nelson Province, is caused by a strain of *Phytophthora Cactorum* (Leb. & Cohn) Schroet. This is apparently the first record of this fungus attacking the hop. For many years a disease of hops known as black root-rot has been observed in the Nelson Province. The disease is prevalent in areas at Riwaka and Motueka where the water-table is high and abnormally wet soil conditions prevail. In such localities it frequently causes serious losses to growers, and in some cases hop-growing has been abandoned in affected areas. Specimens of infected hop roots were obtained from Riwaka in 1936, the causal organism isolated and inoculation experiments carried out to establish its pathogenicity. [Author's summary.]

* Being Volume 36 new series.

171. EVTUSHENKO, G. A. 631.541 : 633.71 + 635.646
Stock and scion influence in *Nicotiana* plants. [Russian.]
Vernalization, Moscow, 1939, No. 3 (24), pp. 49-57.

Grafting experiments conducted with *Nicotiana* plants in 1938 at Krasnodar led to the following conclusions :—1. Cleft grafting and budding cultivated tobacco forms and wild *Nicotiana* plants, as well as intergeneric grafting of tobacco to other *Solanaceae*, are possible under field conditions. 2. The rootstock has considerable influence upon the scion. At the same time the stock itself undergoes certain chemical changes as well as changes of some more stable, inherited, morphological characters such as leaf shape. 3. A vegetative hybrid (Trapezond-Mamont 687 scion-Dubec 44 stock) had the leaf shape, scent and aroma of the stock. The leaf of Dubec 44 on Maryland 1460 stock also lost its original scent and aroma and acquired those of Maryland. The leaf of Dubec 44 scion on common tobacco plant (makhorka) had the characteristic makhorka scent and aroma. 4. The leaves of cultivated tobacco forms worked on stocks of the wild species (*N. glauca*) did not contain the nicotine characteristic of tobacco plants, but contained considerably larger amounts of the alkaloid anabazine* than *N. glauca*. 5. The leaves of tobacco plants grown on potato and tomato stocks did not contain nicotine.

172. WATSON, R. 633.71 : 581.192 : 631.85
Physiological ontogeny in the tobacco plant. 2. The drifts in water content of the leaves in relation to phosphorus supply and topping.
Reprinted from *Aust. J. exp. Biol. med. Sci.*, 1939, 17 : 243-51, bibl. 10.

FLOWER GROWING.

173. LAURIE, A., AND LINK, C. 635.9 : 677.61 : 631.544
Cloth houses.
Bull. Ohio agric. Exp. Stat. 594, 1938, pp. 37, bibl. 19.

Studies in Ohio of the conditions within the cloth house as affecting certain ornamental plants led to the following conclusions :—The colour of the cloth had little or no influence on the plants. Asters produced excellent flowers under cloth. Asters responded with accelerated flower production to shading with black cloth from 5 p.m. to 7 a.m. Shading should begin 7 to 8 weeks after planting. The use of additional light on asters in the seedling stage produced flowers 2 to 25 days before the normal plants. Annual chrysanthemum, annual pentstemon, snapdragon, calendula, cynoglossum, scabious, zinnia, marigold, and other annuals produced larger flowers with longer stems and better colour under cloth. Pompon chrysanthemums grew well under a cloth house when shaded with black cloth from 5 p.m. to 7 a.m. The most satisfactory planting distance for high quality chrysanthemum flowers was 8 by 9 inches. There should be at least one week's interval between the last pinching and the beginning of the shading treatment. Roses under cloth produced flowers of superior quality to greenhouse-grown roses during the summer. Spring flowering perennials or alpine plants are not suitable for cultivation under cloth. Certain pot plants grown under cloth developed into strong, bushy plants. Nursery stock of lining-out size of broadleaf and narrowleaf evergreens does not produce plants sufficiently superior to justify the cost of a cloth house. The cloth house may be used to carry over during the summer certain plants for stock or cutting purposes. Pompon chrysanthemums, asters, *Eupatorium coelestinum*, and Dixie Sunshine marigold responded to shading treatments from 5 p.m. to 7 a.m.

174. MOWRY, H., AND DICKEY, R. D. 635.976.8
Ornamental hedges for Florida.
Bull. Fla agric. Exp. Stat. 323, 1938, pp. 32.

Species and varieties of plant suitable for hedge planting in Florida are here listed alphabetically according to botanical name. The common names are indexed.

* See also *H.A.*, 1939, 9 : 1000.

175. WILSON, R. D. 635.936.832 : 632.3

A bacterial disease of stocks.

Reprinted from *J. Austr. Inst. agric. Sci.*, 1938, 4 : 212-5, bibl. 9.

The disease of stocks (*Matthiola incana*) occurring in New South Wales is thought to be identical with that recorded in California and to be caused by an organism closely related to *Bacterium campestre* (Pammel) E. F. Smith.

176. BARNES, H. F. 632.771 : 635.939.98

The chrysanthemum midge (*Diarthronomyia hypogaea*).

J. roy. hort. Soc., 1939, 64 : 503-6.

An account is given of the chrysanthemum midge, a serious pest in glasshouses in U.S.A. There have been two outbreaks in England, the last, not wholly subdued, in 1936. In the larval stages the midges live within the tissues of the plant where they eventually form cone-shaped galls and cause contortion of the stems and malformation of the flowers. All infected plants should be cut off at ground level, and burnt. There are other methods of control such as spraying nightly for several weeks and dipping cuttings in nicotine 1 : 800 with soap for 5 seconds to kill the eggs and very young larvae, but these are either impracticable or only of limited value.

177. HUDSON, J. P. 635.939.98 : 632.651.3

Warm water treatment of plants.

East Sussex Fmr, 1939, 6 : 85-91.

The warm water treatment of chrysanthemum stools for eelworm is described. A shop-made portable warm-water treating outfit is shown and illustrated instructions are also given for the home construction of suitable apparatus.

178. FIKRY, A. 635.939.516 : 632.452

Study and control of antirrhinum rust.

Bull. Minist. Agric. Egypt 223, 1939, pp. 16, bibl. 26.

In Egypt the most satisfactory control of antirrhinum rust was obtained by various sulphur dusts and "Avon" colloidal sulphur 0.5% with 0.25% soap, if applied immediately after disease appearances and repeated at frequent intervals. 1% bordeaux and burgundy mixtures were effective in checking the disease to a certain extent. Ordinary dusting sulphur, Gaza sulphur and gypsum sulphur gave a complete control of disease. The most suitable intervals between the treatments were 2 to 3 weeks. The control measures resulted in an improved growth and vigour and flower and seed production. A fungus-feeding species of *Cecidomyiidae* has been found parasitic on rust pustules.

179. NEFF, M. S. 664.84.936.69

Problems in the storage of cut carnations.

Plant Physiol., 1939, 14 : 271-84, bibl. 6.

Preliminary experiments with French marigolds had indicated that the life of flowers is shortened by a liberal water supply during storage. The methods of "dry pack" used varied in these experiments at Ames, Iowa. Wrappings of different kinds of paper were tried. A more successful method was to store the flowers in sealed glass or metal containers and a refinement of this procedure made possible the control of the atmosphere under bell jars. Two-hole rubber stoppers supplied with glass tubing were fitted into the openings at the top of the bell jars. Rubber tubing fitted to the outlets facilitated gas analysis. The authors summarize as follows :— Carnations stored at 33° F. were superior to those stored at 40° F. Carnations stored without being placed in water were comparable, in keeping quality and carbohydrate reserves, with fresh carnations. Carnations stored with the stems in water were inferior in keeping quality, and low in carbohydrates. Fresh and "dry pack" storage carnations increased in weight when placed in water at room temperature. Carnations stored in water lost weight at room temperature. There was a correlation between weight fluctuations and keeping quality. Carnations wilted previous to storing dry pack were superior to more turgid dry pack carnations.

In general, fresh dry pack and water stored carnations had the same rate of transpiration. Carnations were favoured by a high humidity. Sealed containers produced this condition; wrapped carnations suffered from desiccation.

180. HORTON, D. E. 635.944
Bulb experiments.

J. roy. hort. Soc., 1939, 64: 251-8.

The paper deals largely with work carried out at the Kirton Agricultural Institute with various commercially grown bulbs. Among the subjects treated are:—effects of hot and cool storage, the favourable results from early planting with narcissi, the favourable effect on size and subsequent flower quality obtained by cutting off the heads of the flowers in full bloom rather than cropping them for market, particularly with tulips; with narcissus the chief result in favour of heading instead of cropping was the increase in number of flowers in the third year. Bringing forcing bulbs into heat too early is a waste of fuel and labour. The system of covering with straw tulip bulbs planted in boxes for forcing is approved; the soil is kept cool and the retardation of development within the bulb caused by heated soil is avoided. The several causes of blindness in tulips are discussed. The propagation of hyacinths is briefly described. There is some mention of the control of pests and diseases.

181. HARGRAVE, J., AND THOMPSON, F. C. 635.944: 632.5
Studies of weed control in tulip and narcissus bulbs.
Report on bulb experiments, agric. Inst. exp. Stat. Kirton, No. 6, July 1939,
 pp. 6-18.

Tulips. The general recommendation for the control of weeds based on statistically analysed results is to apply 5 cwt. calcium cyanamide per acre some time before the foliage appears above ground. *Narcissi.* The same holds good. There was no marked effect on forcing in either case.

182. HARGRAVE, J., AND THOMPSON, F. C. 635.944: 631.4
The forcing of tulips and narcissus bulbs on different soil types.
Report on bulb experiments, agric. Inst. exp. Stat. Kirton, No. 6, July 1939,
 pp. 19-33, bibl. 2.

Tulips. Experiments on the forcing of tulips in different soil types are discussed and the poorer growth shown by bulbs "forced" in silt dredgings and raw silt suggests that these materials are not ideal and that a fertile, light, silt-loam is preferable. *Narcissi.* Little or no deleterious effect was seen when narcissus bulbs were forced in raw or partially weathered silt.

183. THOMPSON, F. C., AND HARGRAVE, J. 635.944: 581.192
The chemical composition of flowering bulbs—tulips, hyacinths and narcissi.
Report on bulb experiments, agric. Inst. exp. Stat. Kirton, No. 6, July 1939,
 pp. 34-7, bibl. 13.
 A review of the literature on the subject.

184. HORTON, D. E. 635.944
Experiments with tulips.
Report on bulb experiments, agric. Inst. exp. Stat. Kirton, No. 6, July 1939,
 pp. 38-44.

From practical experience at Kirton the effects of the following cultural practices are discussed:—repeated cutting of flowers for market; planting deep or shallow—on bulb production; cropping flowers for market—on bulbs when forced; date of lifting and storing—on subsequent forcing; forcing two Darwin varieties, viz. Clara Butt and Inglescombe Yellow.

185. HORTON, D. E. 635.944
Experiments with narcissi.
Report on bulb experiments, agric. Inst. exp. Stat. Kirton, No. 6, July 1939,
pp. 45-7.

The author discusses the cumulative effects of cropping the flowers, and in particular the effect on the bulb when forced.

186. WOOD, J. 635.944
The hot water treatment injury of narcissus bulbs.
Report on bulb experiments, agric. Inst. exp. Stat. Kirton, No. 6, July 1939,
pp. 48-58.

Narcissus bulbs subjected to hot water treatment under present commercial conditions are frequently injured by the treatment. Injury is indicated by stunted growth and malformation of the flowers during the season after treatment. It is more severe if the treatment temperature is too high or if the treatment is unduly prolonged. It is intensified by unsuitable storage conditions and methods of handling the bulbs after treatment. By storing bulbs at a temperature of 80° F. for four weeks prior to subjecting them to hot water treatment, susceptibility to injury has been decreased. It is, however, customary in commercial practice to store lifted bulbs for at least four weeks before subjecting them to hot water treatment, otherwise flower splitting occurs in the trumpet varieties. A trial has been conducted to ascertain how far warm storage may be useful in preventing flower splitting when the bulbs are hot water treated within a period of three weeks after the date of lifting. The time required to decrease the susceptibility of the bulbs to injury by storing them at a temperature of 80° F. is too long to be of practical value to the flower grower. The results of these experiments indicate that all flower injury is not important to the bulb producer, and that flowers can be split by immersing bulbs in cold water immediately after they are lifted. Flower injury resulting from treatment soon after bulbs are lifted is not alone an indicator of injury to the bulb. [Author's summary.]

187. HASTINGS, R. J., BOSHER, J. E., AND NEWTON, W. 635.944 : 632.651.3
Bulb nematode control in iris by hot water.
Canad. J. Res., 1939, 17, Sec. C, pp. 144-6, bibl. 5, being Contr. Div. Bot.
Plant Path. Dep. Agric. Ottawa 576.

The immersion of Spanish iris in water at 110°-112° F. for 60 minutes effectively destroys the bulb nematode. In British Columbia the safe period for nematode destruction in iris by hot water lies between 26 July and 9 August. Thereafter injury to the bulb occurs and is progressively greater as the immersion dates are delayed. It is pointed out that the dates for safe immersion are probably shorter in British Columbia than in North Carolina for instance, since the bulbs appear to attain a greater degree of dormancy when grown in the south-eastern United States.

188. MULFORD, F. L., AND WEISS, F. 635.936.751
Culture and diseases of delphiniums.
Fmrs' Bull. U.S. Dep. Agric. 1827, 1939, pp. 12.

CITRUS AND SUB-TROPICALS.

189. GATTEFOSSE, J. 634.3
Des agrumes du Maghreb aux pommes d'Hesperis. (From the oranges of Maghreb to the apples of the Hesperides.)
Fruits Primeurs, 1939, 9 : 201-4.

The author discusses the origin of the word *agrumes* (citrus). The French have only recently begun to use it, in fact it cannot yet be found in the dictionaries. Although borrowed from the Italian *agrumi* it is not a Latin word, but a survival of a vast prehistoric Mediterranean

civilization of which the degenerated remnants are still to be found in Abyssinia among the Haratin of the northern edge of the Sahara and among the gypsies. The author proceeds to prove that the oranges of the Haratin were the golden apples of the Hesperides, which he places in Morocco. The fact that the orange disappeared from this region and had to be reintroduced afresh from the East is ascribed to an effect of the cataclysm described by Diodorus of Sicily.

190. NAIK, K. C. 634.3-1.537
Some citrus nursery technique trials at the fruit research station, Anantaraajupet, Madras Presidency.

Indian J. agric. Sci., 1939, 9 : 651-73, bibl. 24.

The results obtained at this research station (Kodur) have already been briefly dealt with in the *Annual Report of the Madras Department of Agriculture for 1937-8, H.A.*, 9 : 1536, but are set out more fully in the present paper. The greatly increased take in shield-budding certain citrus on various stocks, when the wood slip was not removed from the back of the bud, over the Indian method of inserting the bud after removal of the wood was clearly established in two successive years. It had no effect on subsequent growth. An appreciable advance in bud break was obtained by cutting back the stock at the time of bud insertion, but the percentage take was somewhat reduced. Delaying the cutting back of the stock until the inserted bud had made 2 inches of growth resulted in a comparatively rapid extension of growth of the bud, more rapid in fact than that following cutting back at the time of insertion. The former practice is therefore recommended.

191. KLIMENKO, K. 634.3 : 581.142
Viability of citrus seeds. [Russian-English summary.]

Bull. Batum subtrop. bot. Gdn, 1937, No. 2, pp. 41-4.

Experiments in 1936-7 gave the following results:—In Novo-aphon lemon and citron seed of fruits picked before normal ripeness matured earlier and in oranges and clementine mandarin later than those picked at the normal stage of ripeness. Seed got from fruits picked at a normal date was capable of germinating for a month after that date. Subsequently viability slowly decreased.

192. PARKER, E. R., SOUTHWICK, R. W., AND CHAPMAN, H. D. 634.3-1.8 : 546.711
Responses of citrus trees to manganese applications.

Calif. Citrogr., 1940, 25 : 74, 86-7.

A progress report is presented of the results of citrus treatment for manganese deficiency directed by the Riverside Experiment Station in Ventura County, California. The symptoms of manganese deficiency resemble in several details the mottling associated with boron excess in soil or irrigation water, with iron chlorosis and with a mild form of zinc deficiency. In zinc deficiency, however, the symptoms are usually confined to the exposed south side of the tree. In severe zinc deficiency the reduction of leaf size is a distinguishing feature. When both manganese and zinc deficiencies occur, symptoms unlike either may be produced. Manganese deficiency symptoms fluctuate and are often reduced during periods of tree growth by the presence of a crop and by certain conditions of temperature and soil moisture which are not specified in the paper. Commercial treatment is not yet worked out. An experimental spraying treatment suggested is 10 lb. manganese sulphate 65-80% pure, 5 lb. soda ash, 100 gallons of water. The most effective time for application is not established.

193. CHAPMAN, H. D. 634.3-2.19 : 546.72
Absorption of iron from finely ground magnetite by citrus seedlings.

Reprinted from *Soil Sci.*, 1939, 48 : 309-14, bibl. 5, being *Pap. Univ. Calif. Grad. Sch. trop. Agric.* 400.

It was shown that the absorption of iron from magnetite used as a source of iron in sand cultures for citrus seedlings is made possible by the formation of intimate contacts between root and iron

oxide particles, in which conditions for the extraction or solution of iron must necessarily be different from those prevailing in the nutrient solution external thereto. The observations suggest that the ability of plants to obtain enough iron from alkaline soils is partly due to contact feeding on iron bearing minerals. The incidence of iron chlorosis in some calcareous soils may vary according to the amount of potentially available iron compounds present. Where iron chlorosis develops under the influence of irrigation it would appear possibly due to the gradual coating over of the iron minerals with bicarbonate present in most irrigation waters.

194. SASO, H. 634.321

Studies on the seedlings of trifoliolate orange.

J. hort. Assoc. Japan, 1939, 10 : 66-72, bibl. 8.

Experiments with the seed of trifoliolate orange at the Kanagawa Experiment Station, Japan, showed that seed sown after mid-January germinated uniformly and that the date of germination of all batches sown up to March was practically the same. Large seeds gave a higher and quicker germination and better growth than small ones. As between large and medium seeds there was no difference. Although the trifoliolate seed is polyembryonic, in many cases only one seedling was produced. Whether single seedlings were usually apogamic or not is not stated.

195. KLIMENKO, K. 634.31

Oranges at the Batum botanical garden. [Russian, English summary 17 lines.]

Soviet Subtropics, 1939, No. 11 (63), pp. 36-40.

Studies have been made at the Batum Botanical Gardens of the local (Black Sea Coast) and imported orange varieties. The age of the trees varied, the principal planting dates being 1912-14, 1929 and 1935. The following conclusions were reached :—Washington Navel showed the greatest degree of frost resistance. It was followed by the Golden Buckeye, the Turkish, Majorca, Du Roi, Old Vini and lastly by Jaffa and Nicense. The highest yields were produced by Old Vini, Majorca, Turkish and Thin-peeled Turkish, while Jaffa, Golden Buckeye, Sanguigno di Napoli and Brazil were definitely poor yielders. Some of the forms grown locally appear to show particular promise.

196. BOISCHOT, P. 634.3 : 668.526.4

Culture de l'oranger de parfumerie. (Growing oranges for essential oils.)

Progr. agric. vitic., 1939, 111 : 200-3, 229-31, 254-7, 281-6.

The oranges grown specially for the production of essential oils in various countries are the sour orange, often known as bigaradier, and the sweet orange, of the kind usually called Portugal. The methods of cultivation are described with special attention to the practices current in France and her colonies.

197. HIRAMATSU, B., AND HIDA, M. 634.322-1.541.11

Experiments on rootstocks for Wase Satsuma orange. [Japanese.]

J. hort. Assoc. Japan, 1939, 10 : 52-61.

The best stocks for the Wase Satsuma orange in Japan are Karatachi (*Aegle sepiaria*) [according to Swingle* = *Poncirus trifoliata* Raf., which is the trifoliolate orange.—Ed.], Rask (Rusk ? Lask ?) and the Yuzu (true citron). Karatachi as a stock gives a very sweet fruit, but the tree remains small and is not a free bearer while the fruit is subject to sunburn. The root system is shallow. The Rask produces freely large sweet and early maturing fruit. It is shallow rooting, easily blown over and subject to sunburn. The Yuzu develops poorly, the yield is poor and the fruit small and sour. It is wind- and drought-resistant and these qualities in a stock to some extent offset the disabilities. In course of time the stock may be improved but as it is now the authors do not recommend it.†

* Bailey's *Standard Cyclopedia of Horticulture*, 1927, 1 : 223.

† Notes on 50 different citrus rootstocks are contained in Investigations on the standardization of citrus trees by propagation methods. *Tech. Commun. imp. Bur. Fruit Prod.*, 3, 1932, 2s.

198. KLOTZ, L. J., AND TURRELL, F. M. 634.31-2.19 : 581.471
Rind structure and composition in water spot of navel orange.
Calif. Citrogr., 1939, 25 : 45, 56-7, bibl. 16.

The structure of the rind of the orange is discussed from the standpoint of injury by water spot or the entry of water into the rind from outside. The damage may be important following prolonged rains when the fruit is near maturity. Experiments are described which show that very little external water can enter through the stomata or the oil glands but that growth cracks and fresh mechanical and chemical injuries are the most frequent avenues of entry.

199. TAKADA, K. 634.322-1.4
Does the geological nature of the soil influence quality in the Unshiu orange ?
 [Japanese.]
J. hort. Assoc. Japan, 1939, 10 : 174-88.

Observations throughout Japan indicate that given reasonable conditions suitable for ordinary orange growing the Unshiu should be able to yield superior fruits.

200. GASHKOVA, O. A. 632.111 : 634.334 + 634.322
The physiological effect of abrupt changes of temperature on lemons and mandarins. [Russian.]
Soviet Subtropics, 1939, No. 11 (63), pp. 33-4.

In Russian experiments the effect was studied of abrupt temperature changes on assimilation, respiration and certain other physiological properties of New Athens lemons and Unshiu mandarins. Assimilation and respiration of the leaves were recorded with the aid of the Ordoyan-Maximova absorbers, the silver plate being substituted by Schott's glass filter No. 1. The leaves used were of the same size and from the same positions on all plants. The following temperatures were used :—(1) 25° C. (momentary), followed by 7° C. for 17 minutes, (2) 25° C. (momentary), followed by 8° C. for 1 hour and (3) 25° C. (momentary), followed by 8° C. for 24 hours. There was a considerable increase in photosynthetic activity and respiration in mandarins in (1). At longer exposures to lowered temperatures (1 hour and 24 hours) photosynthetic activity became almost constant, while the rate of respiration, after rising during the early exposure, fell considerably afterwards. In lemon leaves, on the other hand, there was a fall in photosynthetic activity and rate of respiration during the first hour, both processes showing a slight rise afterwards. The same temperature changes had a different effect on lemons and mandarins. Hence, the author concludes that the relationships of photosynthesis and respiration to temperatures are complex and due largely to stimulation. In the above experiments mandarins and lemons differed widely in their reaction to the same stimulus, namely temperature changes from without. It was assumed that stimulation brings about changes in the protoplasm, and that the irritability of the latter may be measured by its viscosity. In another set of experiments, in which the viscosity of the protoplasm was studied at the time of exposure of the plant organism to abrupt temperature changes (from 25° C. to 8° C.), Weber's centrifugal method was used. The exposures to lowered temperature were :—5, 10, 30 and 40 minutes, and the number of rotations was :—250, 250, 250, 1,000, 1,000. Prior to centrifugal operation the cut surfaces of the lemon leaves were examined and the positions of the plastids in the cell noted. After centrifuging both controls and leaves that had been subjected to abrupt temperature changes were examined. Data indicate that at first abrupt temperature changes cause a sudden fall in the viscosity of the protoplasm in the lemon leaf, but that it increases afterwards. During the first 30 minutes of lowered temperature effect the viscosity became so slight that 250 centrifugal rotations for 1 minute were sufficient for a replacement of the plastids. Soon afterwards, however, the viscosity of the protoplasm increased to such an extent that the plastids did not change their positions even when subjected to centrifugal rotations for 1 hour. The results obtained by the centrifugal method were compared with results of observations on plant cells through the microscope. It was found that under the influence of abrupt temperature changes the plastids change their positions during the first 5 to 10 minutes, the larger chloroplasts changing first, followed by smaller ones until finally all plastids are accumulated at the base of

the cell (morphologically lowest point) where they remain fixed in the same position. The fixation of the plastids is due to the great viscosity of the protoplasm, which is brought about by prolonged exposure to lowered temperature.

201. GREGORY, E. J. 634.323-1.8

A progress report on a large scale manurial experiment on Marsh grapefruit.

A. L. Rhodes, Govt. Printer, Trinidad and Tobago, 1938, pp. 14, bibl. 6.

Manurial trials with Marsh grapefruit on sour orange, rough lemon and "wild" grapefruit stocks carried out in 1933-8 at St. Augustine Experiment Station led to the following conclusions:—Applications of pen manure improved growth and fruiting. Increasing doses of nitrogen also produced a definite effect. Sulphate of potash treatments had very marked effects on growth and fruiting, when pen manure was absent, but the addition of sulphate of potash plus pen manure did not result in any further increase in growth or fruit production. The pen manure used apparently contained adequate amounts of available potash to supply the requirements of the trees. The applications of superphosphate did not result in increased growth or fruit production.

202. MARTIN, W. E. 634.323-1.84

Nitrogen nutrition in relation to yield and quality of grapefruit.

Plant Physiol., 1939, 14: 606-7.

Experiments in Arizona indicate that treatments given to increase the nitrogen content prior to blossoming produce increased yield, but that late summer applications of nitrogen tend to result in coarse-textured, thick-skinned, lower grade fruit. It would appear therefore expedient to withhold nitrogen or at least divert it by cover crops in the summer.

203. GANDHI, S. R. 634.3-1.67

A study of the methods of cultivation of fruit trees with special reference to citrus. Part II. Irrigation.

Trop. Agriculturist, 1939, 93: 68-75, bibl. 2.

In Part I,* among other matters, the manner in which irrigation water penetrates and spreads in the soil was discussed. The subject is continued here with a description of the various types of irrigation systems (furrow, basin, etc.) and of the methods and locally available implements used in their formation.

204. SCHOONOVER, W. R., BROOKS, F. A., AND WALKER, H. B. 632.111: 634.3

Protection of orchards against frost.

Circ. Calif. agric. Exp. Stat. 111,† 1939, pp. 70.

This circular should be of value far beyond the area for which it was particularly written, namely the Californian citrus orchards. It is actually a revision of Extension Circular 40, *Frost Protection in Californian Orchards*, and it embodies certain new recommendations based on recent investigations. A full account is given of orchard heating in Californian orchards. In 1939 some 92,000 acres, or one-third the total area of citrus orchards in California, were protected by orchard heaters. The essential facts to be considered are overhead and operating costs and probable additional income. It is now realized that smoke is a serious nuisance to the general public and that orchard heating must therefore be made virtually smokeless. Among subsidiary methods of combating frost the following are mentioned:—*Wind machines* by which an attempt is made to mix ground air with the warmer upper air. Since, otherwise, there is no guarantee of the presence of warmer air above, the presence of heaters or of a furnace attached to the wind machine would appear desirable. *Water*. Irrigation just before a probable frost provides extra heat, first in the cooling of the water to the freezing point and secondly in giving up latent heat

* *Ibidem*, 1939, 92: 3-15; *H.A.*, 9: 561.

† See also *H.A.*, 9: 1344.

in ice formation. The process will have to be repeated the following night if frost continues. The method is limited by the necessity for large quantities of water and by possible root damage. Spraying is not advocated owing to the danger of breaking the trees with the ice load. *Steam.* Trials of this indicate that the cost of plant is excessive. *Central heating.* The aim here is the provision by piping of warm air to each tree. This is difficult unless there is absolutely no wind. Installation costs are high. *Orchard heaters.* As regards heaters no heater at present meets all the requirements, which are here detailed. In Californian citrus orchards less than 10% of the heating is done with heaters burning petroleum cake, or briquettes made from coke, carbon black or other materials. Their initial cost is less than that of oil heaters but their life is also considerably less. They will not develop heat so quickly as oil burners. As regards efficacy of heating by oil heaters the proportion of radiant heat is greatest in a horizontal plane from large, tall, hot stacks. The choice of heaters should depend mainly on minimum smokiness and reliable operation. In California the usual number per acre is 50 bowl-type heaters for oranges and 60 to 80 for lemon and avocados. These numbers can be reduced if large areas are heated and must be increased in particularly susceptible spots and round the borders of orchards. Deciduous orchards will need a minimum of 40 5-gallon heaters per acre. A mixture of generator type heaters and bowl heaters is sometimes found successful, the generator type being efficacious except on nights of intense frost, when the bowl type will be brought into action. Considerable attention is paid by the authors to the best system of filling, whether by hydrant hose, pipe lines, pails or otherwise. The necessity for an adequate supply of accurate thermometers is stressed. It is also noted that if the bulbs are exposed to the sky, they will lose heat by radiation. They should therefore be sheltered. The apparatus for giving the frost alarm must be reliable. It is suggested that the orchard units should consist of a carefully made large-bore mercury-filled thermometer with a fixed alarm contact point sealed in. Such units are not adjustable on the farm and must be returned to the factory for resetting. Types, storage and heating capacity of different fuel are considered at some length. Among possible fuels discussed are:—various briquettes, wood, rubber tyres, butane-propane mixtures, natural gas and electricity. Finally normal routine practices, including the all-important one of proper cleaning of heaters, are considered in detail.

205. ANON.

634.3-2.111

Orchard heating development told.*Calif. Citrogr.*, 1939, 25: 58-9.

In a brief review of recent progress in the development of oil orchard heaters in California certain points of interest emerge. Over a period of 19 nights the average temperature at 5 feet above ground was colder than at 45 feet. The radiant energy output of coke-burning heaters is comparable to that of oil burned in bowl-type heaters. Attention has been given to the elimination of soot from the inside of oil heaters. This may be achieved either by frequent cleaning with a specially designed brush or by using a heater which does not produce smoke. With regard to the latter, work is proceeding at the University of California with an experimental heater known provisionally as the Leonard return gas heater, in which the chimney is connected with the oil-container by means of a pipe through which a portion of the flue gases return to the space where the oil is vapourized.

206. DULZETTO, F., AND MUSCATELLO, G.

634.31-2.8

Sulla "fetola" delle arance e sulle probabili cause che la determinano.

(Fetola disease in oranges and its probable causes.)*Ital. agric.*, 1939, 76: 685-93, bibl. 7.

The authors give coloured illustrations of the disfiguring phenomenon seen in orange and known under the name of fetola [see also *H.A.*, 9: 977.—ED.]. There seems to be little doubt as to the appearance of the condition, namely small discoloured areas on the skin ranging in size from a few mm. to 15-20 mm., and not penetrating further than 0.5 mm., but with regard to its cause the present authors strongly disagree with Carrante's supposition that it is due essentially to

seasonal and climatic factors aggravated by faulty cultural practice. They note that, although fetola, which has been known for the last fifty years, has suddenly become much more serious in Sicilian groves, no particular climatic change has lately been registered, nor has fetola become more serious in all orchards of a given district. They consider the fact that this affection, once endemic and sporadic, has now suddenly become epidemic in character, points to parasitic origin and they propose to attempt in the coming season to probe the matter further. They make the following tentative suggestion. "The nature of the histological changes in the mesocarp, the not infrequent occurrence of a punctured lesion corresponding with the centre of the damaged area, and the fact that in some badly affected orchards a large number of insects belonging to the genus *Empoaxa* was found, have led us to advance the theory that fetola is produced by a puncture made by these *Homoptera*, without ruling out the possible intervention of other species of insect."

207. McCLEERY, F. C. 634.3-2.4
Black spot of citrus.
Agric. Gaz. N.S.W., 1939, 50 : 618-22.

A summary is given of control experiments on black spot disease of citrus (*Phoma citricarpa*) in N.S.W. The most successful treatment lies in a 4-spray programme of bordeaux $1\frac{1}{2} : 1\frac{1}{2} : 80$, the first spray to be applied when most of the blossoms have fallen from the sunny side of the tree and thereafter every 5 weeks. The bordeaux should be used in conjunction with two white oil sprays for scale and not with soda or oil soda.

208. JOACHIM, A. W. R., AND PANDITSEKERE, D. G. 634.3 : 581.192
The composition of local and imported citrus fruit.
Trop. Agriculturist, 1939, 93 : 14-24, bibl. 22.

209. VERDOORN, I. C. 634.1/7
Edible wild fruits of the Transvaal.
Bull. Dep. Agric. S. Afr. 185, 1938, pp. 55, being *Plant Industry Series* 29, 6d.

The edible wild fruits of the Transvaal or, rather, mainly such of them as are eaten in some form by white men, are described with many illustrations, some coloured. There is a key to help in identification.

210. CRUESS, W. V. 634.63
Observations on olives and olive products in Egypt and Italy.
Fruit Prod. J., 1939, 19 : 11-6, 25, 27-8, bibl. 1.

Egypt. Five principal varieties of olive are grown. These are named and their peculiarities and individual uses described. Propagation is by seed or by grafting or budding on seedling stock. In budding buds nearly ready to shoot should be used; fully dormant buds may not shoot for months after budding. Cuttings in February and March, truncheons or large pieces of root and offshoots from the trunk are also used. The methods, of which there are several, of pickling green olives are described. Considerable faith is placed in a lime-brine treatment which is much used as a preliminary process. It consists of storing the olives for 10 days in 3% slaked lime suspension in 7% salt solution (28% salometer). The processing of ripe olives by Egyptian, European and North African methods is described. *Italy.* An account is given of the olive oil research station at Bari and of the processing of the oil by the latest and most efficient machinery. Of considerable interest are the factories for extracting oil from olive pomace procured from the oil-extracting factories and the process by which this completely inedible extract is converted into a mild pleasant oil used in great quantities for blending with natural non-refined, virgin, olive oil.

211. RZHEVKIN, A. A. 634.63
The olive. [Russian.]

Lenin Academy of Agricultural Sciences, Moscow, 1939, pp. 39.

An account is here given of the more recent work with olives at the Nikita State Botanical Gardens, Yalta, including an account of six olive varieties, which are considered to be the best under Yalta conditions. These are briefly described.

212. VIVOLI, G. 634.63
 Principali aspetti e problemi dell' olivicoltura libica. (**The chief aspects and problems of olive growing in Libya.**)
Agricoltura colon., 1939, 33 : 233-57, bibl. 71.

The author discusses with no little enthusiasm the various problems that confront the olive grower with special reference to Libyan conditions. Among points argued at some length are the following :—propagation by ovules or seed ; distance of planting according to humidity of soil ; mixed planting with vines, almonds or other plants or cultivation alone ; irrigation.

213. BRICHET, J. 634.63-1.541
 La restauration de notre oliviculture par l'emploi des plants greffés de semis.
 (**Improvement of our (Algerian) olive cultivation by the use of plants grafted on seedling stock.**)
Rev. Hort. Agric. Afr. N., 1939, 43 : 173-81.

The impossibility of getting in North Africa any quantity of good varieties of olive true to name and grafted on nursery-raised seedlings is deplored. Much of the rootstock material now consists of wildings dug up and transplanted. These are of all ages up to 10 years or so and are considerably checked in the process so that it may be some years before they are fit to be grafted, and after transplanting to the field there is another long check. This delay and check can be avoided by grafting at an early age on young seedling stocks raised in the nursery. Although, as the author says, the process of stock raising is childishly easy, there is an unaccountable reluctance on the part of North African nurserymen and growers to undertake it. A sowing of olive seeds properly prepared by clipping off the apical end of the hard seed coat (a method of doing this rapidly and accurately is illustrated) will germinate with certainty in 4 or 5 weeks instead of sparsely after many months. After clipping the seeds are stratified in 2 parts sand and 1 part earth until germination starts, when they are transferred to the seed beds, being sown practically touching, in rows 30 cm. apart. After a year in the seed beds, by which time the seedlings are 0.30 to 0.50 metres high, and of pencil thickness they are crown grafted, preferably by de Breuil's method,* as soon as the sap begins to move in spring, when a 90-95 percentage of success should be obtained. In two or three years' time the plants can be planted in the field. Only olives with large seeds should be used.†

214. TALLARICO, G. 634.63-1.541.11
 L'innesto dell' olivastro di Etiopia. (**Grafting the Ethiopian olive.**)
Ital. agric., 1939, 76 : 296-304, reproduced in French in *Rev. Bot. appl.*, 1939, 19 : 693-7.

The author suggests that what he calls the Abyssinian olive, actually *Olea chrysophylla* Lam., might make a suitable rootstock for the European olive, *O. europea*, in Africa. The wild olive of the Mediterranean, which though compatible with the choice European varieties does not always succeed under North African conditions, is suggested as an intermediate stock to bridge the gap in affinity which the author supposes may exist between *O. chrysophylla* and *O. europea*. Direct grafting of *O. europea* onto *O. chrysophylla* should be tried provided the scion varieties

* Differs from crown grafting in that only one side of the rind on the stock is raised, and, after the scion has been prepared in the normal way a second cut removing a thin slice is made alongside the first to fit against the edge of the unraised rind of the stock.

† For fuller information see Vegetative propagation of tropical and sub-tropical fruits. *Tech. Commun. imp. Bur. Fruit Prod.* 7, 1936, 2s.

come from the most southerly districts. When there are doubts as to compatibility the author suggests that the scion should be applied in two sections with an interval of time between the two graftings sufficient to allow the intermediate to settle down before the second scion section is added. He says that by this way a mode of living is evolved between stock and intermediate which neutralizes the incompatibilities to some extent and makes the union and future growth of the top scion much easier.

215. BRYDEN, J. D. 634.63

Fruitfulness in olives.

Agric. Gaz. N.S.W., 1939, 50 : 449-50.

Shy bearing of certain olive varieties at the Wagga Experiment Farm has been found to be due to an excessive production of staminate flowers.

216. MORETTINI, A. 634.6 : 581.145.1

L'aborto dell' ovario nel fiore dell' olivo. (Ovary abortion in olive flowers.)

Ital. agric., 1939, 76 : 815-28, bibl. 15.

A further contribution on the floral biology of the olive [see *H.A.*, 9 : 989]. In his previous article the author had shown that most of the olive varieties in the neighbourhood of Florence and Pistoia are self-sterile. No inter-sterility was noted, but certain varieties were found rather prone to ovary abortion. In the present article he considers the morphological aspects of ovary abortion and its practical consequences. The various stages of atrophy shown by the ovary in such cases are described and it is noted also that in some varieties, where the ovary is normal in appearance, the stigma is lacking or liable to drop at the slightest touch before or during anthesis, or is malformed. An examination of the reasons for ovary abortion is followed by an account of observations on its incidence in the years 1936-9 in Tuscany and Umbria. A consideration of its incidence in the varieties grown allows these varieties to be placed in groups according to whether they show ovary abortion less than 10%, between 10% and 35%, between 35% and 60% and above 60%, and also indicates that ovary abortion is an inherited characteristic. Summing up the evidence from a practical standpoint as regards Tuscany and Umbria he concludes that ovary abortion is apparent to a relatively constant degree in each variety and is an inherited character. Its incidence is not serious in most of the varieties grown. Moreover, when its incidence is high, the crop does not suffer owing to the better fruit set and to the smaller fruit fall which coincide with it. Hence in planting up olives the factor of ovary abortion need not enter into consideration, and attention should rather be paid to oil content and fruitfulness and to the interplanting of a sufficient number of varieties to ensure adequate cross-pollination.

217. SOKOLOVA, N. F. 634.63

Partial or complete degeneration of the pistils of *Olea europea* L. [Russian.]

Proc. Lenin. Acad. agric. Sci. Moscow, 1939, No. 18, pp. 12-15, bibl. 8.

A study was started at the Nikita Gardens in 1938 of the phenomenon known as floral abortion in olives. The varieties used were Coreggiolo, Razzo, Leccino, Sukhumskaya, Dalmatica and Otur. The study of the condition and functioning of the leaves included ringing, defoliation and irrigation trials. Counts of the deformed and abortive flowers indicated that floral abortion is not an inherited character but that it is very largely determined by the condition of the leaves and nutrient supplies in the soil.

218. SCAVONE, G. 633.525.1

Possibilità e convenienza della coltivazione della ramia. (The cultivation of ramie in Italy and her colonies.)

Ital. agric., 1939, 76 : 327-36.

We here have another account of the best methods of growing ramie (*Boehmeria nivea*), see also *H.A.*, 9 : 993. Professor Bruno of Palermo has been responsible for investigations and collection of varieties, which he has distributed widely, especially to Tagiura in Libya, where an area of 40 hectares is devoted to the crop. He considers that given good soil conditions a plantation

will enter into production in 3 years and will show increased production up to the seventh year. After this it should produce a fairly constant amount up to the twenty-fifth year when it begins to decline. It may produce more than $1\frac{1}{2}$ tons of fibre per hectare, i.e. about three to four times that of cotton under similar conditions. The recommended method of reproduction is by rhizomes from mature plants at least 3 years old. The best source are plants which have large cone-shaped roots. Each adult plant will provide 150 rhizomes of usable size. On the average one hectare of mother plants will provide enough rhizomes to plant up 40 hectares. The rhizomes, which should be at least 10 cm. long and should be removed with a very sharp implement, are laid in the shade for half an hour and then planted to half their depth on the side of the furrow with 40-50 cm. between them. The rows should correspond in each direction; 20-25,000 rhizomes will be wanted to plant a hectare. Irrigation must be practised to ensure the humidity of the soil until the emission of the first leaves. It is best done by infiltration. Irrigation, which stops 10 days before cutting begins, is given immediately after each cut. The considerable difficulties in freeing the fibre from its surroundings in the harvested plants are discussed and the possibility of mechanical separation followed by bacterial maceration with *Bacillus felsineus* is noted and different apparatus mentioned. Only one pest appears at all likely to do damage, namely the moth *Hypona lividalis* Hübner, and this is easily defeated by a night spray of soap and oil emulsion.

219. MORGAGNI, E. 633.863.2
 La coltivazione dello zafferanone (*Carthamus tinctorius* L.). (Safflower cultivation.)
Agricoltura colon., 1939, 33: 301-8, bibl. 14.

A plea for the extensive cultivation in Italy of this drought-resisting dye plant, which is said to be peculiarly suitable for infertile calcareous soils. It is sown 3-6 cm. deep, in rows 25-30 cm. apart, either in autumn or after spring frosts, and is later thinned out to 6-10 cm. between plants in the row. Except for slight hoeing in the earlier stages, it needs no further attention. The flower harvest—from an original sowing of $12\frac{1}{2}$ to 16 lb. per acre—should amount to 2-3 cwt., the fruit to 5-5½ cwt. The dye from the flower can be used for fabrics or as a substitute for saffron in cooking. The oil can be used for soap making, varnishes or burning.

220. KOZHIN, A. E. 633.85
Tung tree selection. [Russian, English summary 20 lines.]
Soviet Subtropics, 1939, No. 11 (63), pp. 23-9.

Studies at the Batum botanical garden suggest that all cluster type and female trees of *A. Fordii* may be selected as mother plants for seed propagation but only true female or the best bi-sexual plants of *A. cordata*. Certain characters of the male and female flowers of both varieties, as well as certain other characters determining yield capacity, are described in some detail. It is essential to record the yields for at least four years, starting in the fourth year from sowing in the case of *A. Fordii* and in the sixth year in that of *A. cordata*.

221. KASSAB, A. 632.725
The control of mole-cricket with barium fluosilicate.
Bull. Minist. Agric. Egypt 1933, 1939, pp. 13, bibl. 29.

Barium fluosilicate is very effective as a bait for the destruction of the mole cricket and presents the following advantages over zinc phosphide:—It is cheaper, it is insoluble in water, thus having the advantage of maintaining its insecticidal properties for a prolonged period, it has no odour, its preparation and use are very easy, it is less dangerous to man and beast, does not harm the leaves and can be kept moist. The bait, preparation, handling and application of which are described in full, is as powerful a poison as zinc phosphide, although its action is somewhat slower. Barium fluosilicate bait kills field rats.

222. TSAREV, M. V. 633.956
Methods for stimulation of essential oil production by camphor basil (*Ocimum canum* Sims). [Russian.]

Proc. Lenin Acad. agric. Sci. Moscow, 1939, No. 18, pp. 16-22, bibl. 18.

Russian experiments with camphor basil (*Ocimum canum* Sims) indicate that :—1. Essential oil development can be influenced by encouraging or impeding the accumulation of carbohydrates in the plant. 2. Essential oil production could be brought into direct relationship with the accumulated amounts of carbohydrates. 3. A method is recommended for an increase in essential oil yields. It consists of excising all shoots and branches except the five lower pairs of branches, which are particularly well adapted for the accumulation of carbohydrates. Ringing also gave good results.

223. DAMERON, W. H., AND SMITH, H. P. 634.775.4 : 632.51
Prickly pear eradication and control.

Bull. Tex. agric. Exp. Stat. 575, 1939, pp. 55.

In Texas cactus varieties belonging to the genus *Opuntia* cause much trouble to stock breeders. The most effective method of eradicating these plants consists of spraying in June, July, August and September with an arsenic pentoxide solution (3 lb. to 1 gallon of water), to which is added 1 pint of commercial strength sulphuric acid.

224. GAYEL', A. 633.689
A new starch plant of the sand desert. [Russian.]

Bull. appl. Bot. Leningr., 1936, Ser. A, No. 19, pp. 61-4.

The roots of Jau-jumur, a plant of the genus *Ferula*, contain over 40% starch. The plant, which grows in the South Kazakhstan, has been long in native use as a food plant.

225. COMPERE, H. 632.752 : 632.96
Mealybugs and their insect enemies in South America.

Univ. Calif. Publ. Ent., 1939, 7 : 57-74, being *Pap. Univ. Calif. Grad. Sch. trop. Agric.* 356.

The occurrence in Brazil is reported here of four species of mealy bug which are internationally known as serious pests. The general non-injuriousness of these well-known cosmopolitan species in Brazil, as well as the non-injurious character of many of the endemic species, is attributed in large measure to the work of predators and parasites. In marked contrast to the mealy bug conditions in Brazil is the situation in Central Chile, where the endemic coccid fauna is meagre. Only four species of mealy bug were noticed there, none apparently being native to Chile, but all introduced accidentally through imported nursery stock. All four species were common and occurred in injurious numbers. No effective insect enemies of mealy bug were found in Chile.

226. COMPERE, H. 632.752 : 632.96
The insect enemies of the black scale, *Saissetia oleae* (Bern.), in South America.

Univ. Calif. Publ. Ent., 1939, 7 : 75-90, being *Pap. Univ. Calif. Grad. Sch. trop. Agric.* 399.

EIG, A. 581.9

The vegetation of the light soils belt of the coastal plain of Palestine.

Palestine J. Bot. (J.), 1939, 1 : 255-308.

ZOHARY, M. 551.453 : 581.9

To the knowledge of the flora of the Syrian desert.

Palestine J. Bot. (J.), 1939, 1 : 241-54.

ANON.

633.956

Trials of camphor tree cultivation in the Ukraine.

Moscow, Selkhozgiz, 1939, 0.20 roubles.

- POPOVA, G. M. 633.88.32.491
An ecological classification of castor-oil plants. [Russian.]
Proc. Lenin Acad. agric. Sci., Moscow, 1939, No. 19, pp. 10-15.
- PROKHOROVA, N. T., AND PROZOROVSKAYA, L. L. 633.842
A calorimetric method for determination of the amount of capsaicine in *Capsicum*. [Russian.]
Proc. Lenin Acad. agric. Sci., Moscow, 1939, No. 16, pp. 41-7, bibl. 26.

TROPICAL CROPS.

227. STOCKDALE, F. 581 : 633/635
The application of economic botany in the tropics.
Bull. imp. Inst., 1939, 37 : 546-54.

Sir Frank Stockdale briefly reviews the progress that scientific research has made in the improvement of some of the economic crops on which agriculture in the tropics depends.

228. PRESCOTT, J. A. 551.63
The agricultural possibilities of monsoonal Australia.
 Reprinted from *Proc. roy. geogr. Soc. Aust., S. Aust. Br.*, 1937-8, pp. 52-60.

A list is here given of grain crops, edible legumes, bulbs and tubers and fibre crops that might possibly establish themselves in monsoonal Australia. It is compiled from recent literature dealing with crops cultivated under similar external conditions in West Africa. Fruit is scarce, but the mango may be mentioned, since it is relatively drought-resistant and grows well in the monsoonal climate.

229. SAMPSON, H. C. 588.144.2
Roots.
Trop. Agriculturist, 1939, 93 : 179-83, reprinted from *Emp. Cott. Gr. Rev.*, 1939, vol. 16, No. 3.

The article emphasizes the need for research on the root systems of crops grown in the tropics and sub-tropics. Owing to the effect of environment on roots, many instances of which are given, and to the much greater range of environment in the tropics such research is even more important than in temperate zones. Many ways in which knowledge of the root systems of plants can be turned to profitable account in cultivation and selection are pointed out with examples.

230. RUBBER RESEARCH INSTITUTE OF MALAYA. 632.693.2
Rat control.
Circ. Rubb. Res. Inst. Malaya 7, pp. 4.

The Institute for Medical Research continues its efforts to discover a virus which will be effective against rats in Malaya. Of the chemical poison baits used under field conditions, where alternative unpoisoned food is always available, phosphorus and thallium sulphate baits are likely to give the best results.

231. GORRIE, R. M. 631.459
Reclamation of torrent-ruined lands : a Punjab contribution to rural reconstruction.
Agric. Live-Stk, India, 1939, 9 : 248-50.

The problems presented by and the methods used to combat soil erosion in the Punjab are discussed. The chief difficulties lie in the reluctance of the villagers to undertake the work, unless some incentive other than the promise of future benefits is provided.

232. GORRIE, R. M. 631.459
The problem of soil erosion in the British Empire with special reference to India.
Agric. Live-Stk, India, 1939, **9** : 167-89, bibl. 7, reprinted from *J. roy. Soc. Arts*, Vol. **86**, No. 4471.

The cause and cure of soil erosion is discussed with special reference to the particular problems presented by Indian topographical, climatic and social conditions.

233. KING, H. C. 631.459
Erosion. A Mauritian measure for protecting water-courses.
Trop. Agriculturist, 1939, **93** : 276-8.

By making it compulsory for all riparian proprietors to maintain a strip of woodland along the river banks of a width varying from 50 to 10 feet according to the classification of the river, erosion in Mauritius has been largely controlled. Other objects attained by this enactment, which has been in force since 1875, are discouragement of the breeding of mosquitoes by ensuring complete shade over the waters, the improvement of defective catchment and the maintenance of a perennial flow without marked seasonal fluctuation and the provision of a refuge for insectivorous birds. The article discusses the nature of the vegetation, plans for the substitution of bush by fruit trees and the methods of enforcement and supervision of the system.

234. ACHARYA, C. N. 631.875
Comparison of different methods of composting waste materials.
Indian J. agric. Sci., 1939, **9** : 565-72, bibl. 2.

A comparison of different methods of composting town and farm wastes made at the Indian Institute of Science, Bangalore, showed the superiority of the hot fermentation process over the usual aerobic methods, i.e. decomposition in open trenches or in heaps above ground, both in plot trials and in the laboratory. In hot fermentation the compost is kept aerobic for a preliminary period of 5-6 days, during which time there is rapid decomposition and rise of temperature to 65°-70° C. The mass is then covered over with a layer of mud paste and a layer of earth for 2½-3 months to allow anaerobic rotting to take place. By suitable dilution with soil compost the hot fermentation process gave about 1½ times as much manure as the aerobic method. A higher recovery of organic matter and nitrogen (about 1½ times) was also obtained than with the aerobic method. Indications were given that the theories governing the composting of waste material need re-examination. The hot fermentation process is to be examined more critically in a series of papers beginning *ibidem*, p. 741. They will be abstracted when complete.

235. CHILD, R., EDEN, T., AND SALGADO, M. L. M. 631.84
A note on the loss of ammonia from fertilizer mixtures.
Trop. Agriculturist, 1939, **93** : 210-12.

Detailed findings are to be published later, but meanwhile it can be said that there is no reason to fear appreciable loss of nitrogen from manure mixtures containing mineral phosphate, sulphate of ammonia and muriate of potash stored under reasonable conditions. The contrary results of previous experiments are attributed to the smallness of the samples used.

236. KEILLER, P. A. 631.8
Losses caused by mineral phosphates in mixtures with sulphate of ammonia.
Trop. Agriculturist, 1939, **93** : 205-9.

Experiments in the storage of mixtures of sulphate of ammonia and mineral phosphates or bone meal under varied conditions have shown only negligible losses, nor did the mixture become lumpy even under unnaturally severe conditions.

237. HARDON, H. J. 631.84
Een onderzoek naar veranderingen van den grond bij voortgezette bemesting met chilisalpeteer en met zwavelzure ammoniak. (**An investigation of the effect on soil properties in the tropics of continued applications of Chile nitrate and ammonium sulphate.**) [English summary.] *Meded. alg. Proefst. Landb., Buitenz.*, 35, 1939, pp. 15, f. 0.30.

238. FROGGATT, J. L. 632.944
Fumigation and fumigants.
New Guinea agric. Gaz., 1939, 5:1:11-5.

The value of the following chemicals as fumigants for the destruction of insect pests in the soil and on the plant and of rodents is described and notes are given on the method of employment. Hydrocyanic acid, carbon disulphide, paradichlorobenzene, ethylene oxide, sulphur, nicotine, carbon tetrachloride, chloropicrin.

239. SCARONE, F. 632.951
Quelques plantes vénéneuses américaines et asiatiques aux propriétés insecticides. (**Some poisonous American and Asiatic plants having insecticidal properties.**)
Agron. colon., 1939, 28:257:174-84, 259:13-18.

Notes are given on the poisonous properties of a number of American and Asiatic plants belonging to some 50 different genera. The native uses of these plants are mentioned. In a number of instances there is no mention of any insecticidal properties.

240. GEORGI, C. D. V., AND TEIK, G. L. 632.951.1
Variation in toxic content of roots of *Derris malaccensis* var. *Sarawakensis* with increase in age of plants.
Malay. agric. J., 1939, 27:134-40, bibl. 4.

The yield of root for this species, *Derris malaccensis* var. *sarawakensis*, is attributed to the heavy nature of the soil. The proportion of rotenone to ether extract was however high for the species. Heavy soil is definitely unsuitable for *Derris* besides increasing the expense of harvesting. In the two experiments laid down there was a gradual increase of toxic quality up to 23 months and a decrease in ether extract after this age. The early optimum development of toxic content in the root is of considerable practical importance.

241. GEORGI, C. D. V., LUCY, A. B., AND TEIK, G. L. 632.951.1:631.8
Manurial trials with derris.
Malay. agric. J., 1939, 27:222-33, bibl. 2.

In manurial trials by the Malayan Department of Agriculture *Derris malaccensis* var. *sarawakensis*, which yielded poorly on the control plots, nearly doubled its yield of root per acre as a result of manurial treatment. Of these lime at the rate of half a ton per acre was the most economical, being half the cost of NPK and giving nearly as good results. There was no influence on the rotenone content of the root which in this species is usually below the minimum market standard of 5%. *Derris elliptica*, Sarawak creeping, gave nearly four times the yield of the previous species on the control plots and was unaffected by manures in yield or toxic quality. The harvesting of the fine stem roots associated with plants of this species is shown to be a doubtful economic proposition.

242. GEORGI, C. D. V., AND TEIK, G. L. 632.951.1
Preliminary results of analysis of clonal types of derris under field conditions.
Malay. agric. J., 1939, 27:302-31, bibl. 7.

The early history of the investigational work is summarized and the latest findings described. The work was carried out with *Derris malaccensis* var. *sarawakensis* and *D. elliptica*, Sarawak creeping, grown from cuttings of plants having superior toxic content. Some general findings

were :—Wider spacing increased the root weight over that of the parent plants at the same age ; there were wide variations at all ages between the weights of root from individual plants of the same vegetative progeny under the conditions of the experiment ; the yield of root increases with the age of the plant up to 24 months with *D. m. var. sarawakensis*, but with *D. elliptica*, Sarawak creeping, there was a slow increase up to 34 months. This species is characterized by a marked root development, it also shows more variation in root character than *D. m. var. sarawakensis* ; development of toxicity takes place at a much earlier age than previously believed, thus the proportion of ether extract in the root of a parent plant aged 24 months may be less than that of its vegetative progeny at 13 months ; up to 10% variations may exist between parent and progeny and between progeny of the same parent under similar conditions ; the ether extract varies with the size of the root. In *D. m. var. sarawakensis* the ether extract decreases with decreasing size of root and with *D. elliptica*, Sarawak creeping, the roots of diameters $\frac{1}{4}$ – $\frac{1}{8}$ in. have the highest ether extract followed by those of $\frac{1}{2}$ – $\frac{1}{4}$ in., the lowest ether extract being from roots of $\frac{1}{8}$ in. or less ; there was a possibility of wide differences in rotenone content of any two members of a vegetative progeny selected at random. *D. elliptica*, Sarawak creeping, was shown to be a satisfactory type for planting on a large scale and meets the demand of English and American markets. *D. m. var. sarawakensis* has a rotenone content too low to admit of selling on a basis of rotenone content and it can only be sold on a basis of ether extract. No explanation can be offered at present of the wide variation in the figures of yield of root and toxic content of numbers of a vegetative progeny. An experiment is in progress to see whether these characteristics are influenced by the size of the original cutting.

243. GUILLAUME, A., AND HERVÉ, G. 632.951.1
L'appréciation de la valeur insecticide des plantes roténonées d'après le dosage de la roténone. (**Appraisal of the insecticidal value of rotenone-bearing plants according to the rotenone estimation.**)
Rev. Bot. appl., 1939, 19 : 552-64, bibl. 9.

A number of methods of determining the rotenone content of *Derris*, *Lonchocarpus*, *Tephrosia*, etc., are discussed with a view to finding a rapid and reliable method suitable for use on commercial samples. The methods finally selected were the blue colorimetric method and the methoxyl group method.

244. FOSCOLO, E., AND LEFEVRE, P. C. 633.492
Culture et parasites de la patate douce dans l'Ituri. (**Cultivation, pests and diseases of the sweet potato in Ituri (Congo).**)
Bull. agric. Congo belge, 1939, 30 : 404-20, bibl. 12.

The pink-skinned variety has been found in trials to be superior to the white-, red- and yellow-skinned varieties in yield, in the length of time it can be left in the ground—since once lifted sweet potatoes soon perish—in taste even when old, and in immunity to the sweet potato weevil (*Cylas formicarius*). It also takes longer to mature (9-11 months) and so is of value as a comestible rotational crop. The crop is grown on the flat, being planted 25 cm. deep or in hills or ridges. The two latter methods, though less trouble, often give rise to damage from drought. Planting material is provided by tubers or cuttings. The former method is less certain in results, the material more difficult to obtain in quantity, the yield of the supplying field is reduced by one-third and the growth is slow. With cuttings material can be obtained in quantity without normally affecting the yield of the supplying field. The methods employed by the planting gangs are described. Experiments at Dele with various parts of the shoot showed that 92% of the terminal cuttings rooted, 81% of the middle and 40% of the basal cuttings. The length for terminal cuttings is 40 cm. and the age of the supplying plants, if grown without check, is 3 months ; after that the plants will be in flower and the choice of cuttings restricted. If cuttings are required from older plants they are obtained from lateral shoots, which can be increased in number by cutting back the plants. The native practice of wilting the cuttings under shade before planting has been found to result in a higher percentage of rooting and in the production of lateral shoots useful later for providing a succession of

cuttings. Two hoeings are given and hand weeding if necessary. The crop is harvested by plough after a preliminary harrowing to remove the vines. The increase in yield at Dele due to the use of manures, 50-75 kg. bone phosphate and 75-150 kg. sulphate of potash per hectare, was 7-16 tons per hectare. When selecting plants for propagation by cuttings the following characters should be looked for. Deep green colour of foliage, freedom from pests and diseases, numerous regular tubers grouped close to the base of the plant, long-keeping quality before digging. When raising plants from seed the productive value of a plant cannot be gauged until the second generation of cuttings. The first generation is taken from the seedling plant as soon as it has reached a normal development. It is advisable to select seed from fields of mixed selected varieties with the object of obtaining hybrids, since there is no point in propagating by seed except for this purpose. The local pests and diseases are described.

245. TOXOPEUS, H. J. 633.513
Aanteekeningen over de kapokcultuur in fransch Indo-China. (**Kapok cultivation in French Indo-China.**)
Landbouw, 1939, 15 : 598-614, bibl. 3.

An account is given of the kapok cultivation of French Indo-China. The yield of kapok is seen to be very dependent on water supply. The most successful areas are those within 100 metres of river banks, of low or moderate height, or along lagoons formed by flood water. The height of the water table is apparently of more consequence than the constitution of the soil. The principal pest is a stem-boring beetle (*Plocoderus obesus* Ganon) unknown in Java. In the harvesting there is a good deal of waste through the pods ripening in succession. It is not considered worth while to make more than one picking, so that ripe and unripe pods are picked indiscriminately, spread out to dry and those that fail to dehisce are opened by hand and many of these are unusable. There is some discussion as to the value of the recently introduced Togo kapok tree compared with the Java and Cambodia kapoks. It appears to be more subject to insect attack. Its supposedly better drought-resistance is open to doubt.

246. MOQUILLON, —. 633.524.3
Notes sur le polompom. (**Notes on *Thespesia Lampas*.**)
Agron. colon., 1939, 28 : 161-73.

The possibilities are discussed of utilizing as a source of commercial fibre the malvaceous plant, *Thespesia Lampas* Dalz and Gibs. known in its native Indo-China as polompom. It is an adaptable plant as regards soil conditions, provided these are not dry, comes readily from seed and is perennial. One of the very few plantations has yielded profitably for 8 years. The fibre resembles that of jute but is coloured and rough. It should be possible, however, to eliminate both these characters by retting. Favourable reports have been received from manufacturers in France and Germany. Suitable cultural treatments are discussed.

247. CALVINO, M. 633.529
Il baobab e i suoi prodotti. (**The baobab and its products.**)
Ital. agric., 1939, 76 : 105-6.

A brief account of the uses of the baobab (*Adansonia digitata* L.). Among uses of different parts of this huge tree the following may be noted :—the hollow trunk as a habitation, young leaves as a spinach-like vegetable, powdered dried leaves to counteract sweating, hollowed trunks as canoes, the bark for a fibre from which the finest quality paper for banknotes can be made, the fruit for eating, being known in some places as "monkey bread". It is also used as a febrifuge. The cotyledons contain a cooking oil of pleasant flavour.

248. MERCADO, T. 633.682 : 575.252
A comparative study of two bud sports of cassava and their parent varieties.
Philipp. Agric., 1939, 28 : 308-15, bibl. 2.

At the Philippine College of Agriculture non-variegated bud sports of a variegated variety of cassava (*Manihot utilisima* Pohl) and non-curled bud sports of a variety with curled leaves

produced significantly more storage roots and starch and larger and longer stalks than did the parent plants. The author claims that this experiment tends to show that improvement of yield in cassava is possible through bud sports. He does not however give data to show how these yields from apparently normal bud sports of what might be classed as abnormal varieties compare with normal cassava yields.

249. MOLEGOODE, W. 633.689

Tannia or the coco-yam.

Trop. Agriculturist, 1939, 93 : 279-80.

An account of the cultivation of the various kinds of edible *Colocasia* and *Alocasia* in Ceylon.

250. WHITNEY, L. D., BOWERS, F. A. I., AND TAKAHASHI, M. 633.689

Taro varieties in Hawaii.

Bull. Hawaii agric. Exp. Stat. 84, 1939, pp. 86, bibl. 10.

This bulletin presents a key to the taro varieties (*Colocasia esculenta*) based on vegetative characters and descriptions of the taros found in Hawaii, with all available information as to origin, distribution and use.

251. PARK, M., AND FERNANDO, M. 633.71-2.4

A convenient method of determining the incubation period of a plant pathogen in the field.

Trop. Agriculturist, 1939, 93 : 213-4.

The time taken for the development of latent infections after the application of a protective spray to an infected leaf showing initial symptoms of frog-eye disease (*Cercospora nicotiana*) of tobacco is used to determine the length of the incubation period of the pathogen in the field.

M.E.K.

252. WIGHT, W., AND BARUDA, P. K. 633.72

The tea plant in industry : some general principles.

Trop. Agriculturist, 1939, 93 : 4-13, bibl. 9.

The nomenclature of the tea plant is discussed. Pending the report by the special committee appointed by the International Botanical Congress in Amsterdam, 1935, to decide on the correct names, according to the international rules, of important economic plants, it has been decided by the tea industry botanists of India and Ceylon to use the name of *Camellia Thea* Link as being the most accurate of the eleven different names assigned to this plant by systematic botanists at various times. The chromosome number of the teas of South India is 30. This number has also been established for a China type. The tea plant is largely self-sterile and varying degrees of compatibility with surrounding plants can be found. Self-fertilized seed gives plants inferior in vigour and is of reduced germinating capacity. Complete artificial cross-pollination has resulted in 13% of the flowers setting as against 2% under natural tea seed garden conditions. The high self-sterility of tea results in all tea seed being of mixed ancestry. Clonal planting of vegetatively propagated tea for leaf production is unlikely, but such plantings of selected material would form a useful supply of pedigree seed if suitable pollinators were provided. Dark-leaf tea types, particularly small-leaved kinds, are more frost-resistant than light-leaf types and possibly some of them are more drought-resistant. There is no evidence to associate susceptibility to die-back to any particular leaf colour. Generally light-leaf *jats* give the better quality tea, though individual dark-leaf bushes of excellent manufacturing quality can be found. The personal factor in tea tasting for experimental work renders the method very inexact compared with ordinary standards of scientific measurement. The material basis on which this sense of quality rests are probably substances known to the chemical and physical sciences but their identity is yet to be discovered.

253. VAN ROGGEN, M. A. 633.72
De veredeling van oude theezaadtuinen. (Improving old tea seed gardens.)
Bergcultures, 1939, 13 : 1398-1405.

The methods by which old tea seed gardens are brought up to date by the inclusion of improved material and the suppression of plants of low performance are discussed.

254. VAN EMDEN, J. H., AND DE HAAN, I. 633.72-1.535
Voorloopige mededeeling inzake het stekken van thee. (Preliminary report
on the propagation of tea by cuttings.)
Arch. Theecult. Ned.-Ind., 1939, 13 : 75-85, bibl. 14.

Using a shaded glass-covered propagator, in which the temperature was maintained between 24° and 28° C. and the light intensity at 5-10% of that in the open, and as a rooting medium 12 inches of well-drained river sand, the percentages of rooting of tea cuttings after 12 weeks were as follows :—banji shoots 98%, peko shoots 49%, single internode cuttings 57%, 3-internode cuttings 57%. None had died. Standing the cutting bases for 36 hours in 100 mg/l β -indolyl-acetic acid produced 80% rooting in 6 weeks, in 50 mg/l for a similar period 10%. Similar treatment for 16 hours produced no effect. Treatment with heteroauxin in lanolin paste was also ineffective.

255. DE GEUS, J. G. 633.72-1.543.1
Schaduw en bemesting en de kwaliteit van thee. (The effect of shade and
manure on tea quality.)
Bergcultures, 1939, 13 : 1474-85.

The effect of shade on tea quality is at present undetermined and deserves serious research. It is pointed out that the shade tree has other uses besides providing shade; its roots break up the pan and so enable the tea roots to penetrate deep, while the foliage provides a green manure. On the whole the tendency among planters seems to be to expose the green parts of the plant to full light, while protecting the roots with some low-growing shade plant which can be cut and used as a green manure. After reviewing some of the work done abroad on the influence of manure on quality, the author concludes that while manuring benefits the tea as regards its vegetative processes it has no direct effect on the quality of made tea.

256. COOPER, H. R. 632.72-1.8
Manuring of tea in wartime.
Mem. Indian Tea Assoc. Tocklai exp. Stat. 10, 1939, pp. 22.

On the basis of a study of economic manuring of tea in India, the following suggestions are made :—For mature tea the application of potash and phosphoric acid may without harm be suspended for a long period. Young plants should be given Indian produced nitrate of potash at 1½ oz. per plant. The nitrogen supply must be maintained on all plantations, or crops will be reduced. Leguminous crops or newly planted leguminous trees among tea do not result in immediate crop production, and, although they prevent a deterioration in future, their first effect is to reduce the crop. Growing *Boga medeloa* among tea was found to be effective and to cause relatively small preliminary loss of tea crop. Heavily shaded areas require no manuring. On moderately shaded areas the rate of loss of tea crop will be slow, if manuring ceases, and the final level of fertility will remain relatively high. On areas of good tea on normal soil, without leguminous trees, or with very young, very poor or very widely spaced shade trees, the loss of crop in the first year of cessation of manuring may be as much as 2 mds. tea per acre, but deterioration will progress till only about 5 or 6 mds. per acre are produced.

257. HALCROW, M. 633.73-1.55
Individual tree recording for yield and quality.
Mon. Bull. Coffee Bd Kenya, 1939, 5 : 210-1.

The method of tree selection used with coffee by the Scott Agricultural Laboratories, Kenya, is described. The uneconomic trees averaging less than 5-6 cwt. per annum are about 10%, but

on examination it will be found that nearly all replacements are in this category, which reduces the number of real passenger trees to much less than 10%. Thus individual tree selection must not be looked to as a cure for all ills and certainly not as a substitute for good cultivation. The value of selection for increasing yields in Kenya on plantations where optimum cultivation exists has not yet been established, but with *robusta* coffee in Java in similar circumstances selection has resulted in improved yields.

258. ANON. 633.73-1.55

Coffee industry. Testing the leaf/crop ratio theory.

Mon. Bull. Coffee Bd Kenya, 1939, 5 : 174.

Experiments have been initiated on a number of estates, to examine the influence, if any, of the leaf/crop ratio on the liquorer's report. Both natural and artificially induced high and low ratios are being examined on the multiple and single stem systems, both shaded and unshaded.

259. SCHWEIZER, J. 633.73 : 581.144.4

Over de functie van het blad bij het cultuurgewas gedurende een vegetatieperiode. (**Functions of the leaf in a growing crop.**)

Bergcultures, 1939, 13 : 1638-9, bibl. 17.

The functions of the leaf are discussed with special reference to coffee and the recent investigations on the physiology of the coffee leaf [e.g. Nutman's work, *H.A.*, 1939, 7 : 457, 1019, 1020]. The effects of various unfavourable environmental conditions on the foliage are described and in some cases illustrated by photographs or graphs.

260. MAYNE, W. W. 633.73-1.53/4

The possibilities of vegetative propagation of coffee.

E. Afr. agric. J., 1939, 5 : 186-9. Reprinted (in part) from *Plntrs' Chron.*, Dec. 1938.

The situation as regards the vegetative propagation of coffee is reviewed from the standpoint of progress made and future prospects.

261. TANGANYIKA TERRITORY. 633.73-1.535

A note on a preliminary investigation with possible rooting media for cuttings of *Coffea arabica*.

Quart. Notes Coffee Res. Stat., Lyamungu, Moshi, 1939, No. 9, pp. 7-10 and No. 11, pp. 7-10.

In an experiment in rooting media for cuttings of *Coffea arabica* peat moss 2 parts + coarse sand 1 part was consistently good. (The peat moss incidentally was not fresh owing to lack of material.) Coconut fibre and coarse sand 2 : 1 was also good, but the cuttings took longer to root. Coarse sand is to be preferred to fine sand. Leaf mould can be used, but is less satisfactory. Sand alone was not used in these experiments, there being indications that coffee cuttings root best in a partly organic mixture. These results are not regarded as final. A further experiment in which peat moss + coarse sand 2 : 1 and 1 : 1 was compared with coconut fibre + coarse sand in similar proportions resulted in a superiority of peat moss and sand in either proportion over coconut fibre and sand and a superiority in the 1 : 1 mixture of coconut fibre and sand over the 2 : 1 mixture. It is considered, however, that given time, over six months, the coconut fibre and sand mixture would root as many as the peat moss and sand and it is easier to obtain in tropical countries.

262. ANSON, P. V. 633.73-1.874

A system of coffee cultivation in dry areas.

Mon. Bull. Coffee Bd Kenya, 1939, 5 : 112-3.

The author describes how planting a cover of Napier grass restored his failing coffee to vigour and eliminated the mealy bug with which it was covered, possibly by creating conditions

unfavourable to the Pheidoli ant. The rejuvenation was so complete that a decision to close down the plantation was reversed. It is stressed that equally good results may not be obtained in other localities. There is a note by the Chief Research Officer, Kenya, observing that Napier grass does not cause the coffee to suffer during droughts, but pointing out that there are indications from elsewhere that continuous intercropping may be harmful. Experiments have been laid down at the Karimani Experiment Station.

263. DE FLUITER, H. J. 633.73-1.531
 Waarnemingen betreffende het bewaren van zaadkoffie. (Storing coffee seed.)
Bergcultures, 1939, 13 : 1506-12, bibl. 14.

Experiments are described from which it is concluded that in Java, by taking certain precautions, good germinating coffee seed can be made available at any time of year. Reactions to storage vary with the clone, some varieties losing their germinating power sooner than others. The moisture content of the beans affords an indication as to their storage quality though resistance to low moisture content is variable. In no variety could germination be obtained if the moisture content was lower than 25%. The germination of *arabica* was least affected by a low moisture content while some *robusta* varieties were found to dry up more quickly than others in similar storage conditions. Disinfection of six months stored coffee seed by the turpentine method had no harmful effect. The turpentine method consists of superimposing 5 cm. thick layers of coffee seed between single layers of cloth impregnated with turpentine and keeping them there for 4 days. The containers are boxes 65 × 75 × 70 cm. An increase in germination of 30% but no increase in duration of viability was obtained by treating the seed with 1/100,000 tri-indole-acetic acid. Treatment with Belvitan, a proprietary growth substance, had no result.

264. DEAN, L. A. 633.73 : 551.571
 Relationships between rainfall and coffee yields in the Kona district, Hawaii.
J. agric. Res., 1939, 59 : 217-22, bibl. 3.

Statistical analyses of data on rainfall and coffee* production for the years 1901 to 1936 in the Kona district of Hawaii show two distinct periods of heavy rainfall and one period of markedly light precipitation. The dry season occurs during the winter months, and the months that have low mean rainfall have the most irregular rainfall. Much of the variability in annual coffee production may be ascribed to fluctuations in the February to June rainfall occurring during the years in which the fruiting wood was produced. [Author's summary.]

265. BEAUMONT, J. H. 633.73
 An analysis of growth and yield relationships of coffee trees in the Kona district, Hawaii.
J. agric. Res., 1939, 59 : 223-35, bibl. 13.

The author concludes from a study of the yield and growth measurements of two groups of *C. arabica* coffee trees, one 7 years old and relatively low in vigour and production and the other 12 years old and highly vigorous and productive, that the same relationships, with minor exceptions, exist in both groups. That certain growth responses of the tree are largely dependent upon or conditioned by the size or volume of the developing crop. That the volume of the crop is largely determined by the growth made in the preceding growing and crop season. That a dominant weather factor, such as spring rains, may disturb these relationships, as Dean† has shown, but the tree will resume its normal, overlapping, 2-year growth-and-bearing cycle in succeeding average years. That by judicious pruning and fertilization—the first of which would tend to reduce the current or immediate year's crop and both of which would tend to increase the production of vigorous fruiting wood—and perhaps by other cultural practices such as mulching which would tend to conserve moisture, the extreme fluctuations in annual yields may be reduced and the average yield as well as the general size and vigour of the tree may be considerably increased.

* *C. arabica*.

† See abstract 264.

266. ALMENGOR, A. A. 633.74
 El cultivo del cacao en Suchitepéquez. (**Cacao cultivation in Suchitepéquez.**)
Rev. agric., Guatemala, 1939, **16**: 150-4.

An account is given of the methods of cacao growing in Guatemala. Two types of cacao are available, Costa Rican and Nicaraguan. Both are considered inferior in quality to the local brand but have the merit of higher yield. The Nicaraguan strain is preferred to the Costa Rican because it has the closer resemblance to the native strain in shape and colour and has a larger bean and because, unlike the Costa Rican, it does not germinate in the pod if not picked as soon as ready. The remainder of the article is concerned with normal routine practice. The annual washing of the trunks with lime to a height of 3 feet is strongly advised.

267. OSTENDORF, F. W. 633.74 : 581.145.1/2
 De bloeislaging van de cacao. (**The setting of cacao blooms.**)
Bergcultures, 1939, **13**: 1539-44.

This paper is mainly an exposition of the results obtained by Pound, Posnette and Voelcker* in Trinidad in their investigations into the self-fertility and self-sterility of cacao flowers and the practical application of the knowledge thus obtained.

268. KOOLHAAS, D. R. 633.81
 Cananga- en ylang-ylang-olie uit de bloemen van *Canangium odoratum* Baill.
 (**Cananga and ylang-ylang-oil from the flowers of *Canangium odoratum***
 Baill.) [English summary.]
Landbouw., 1939, **15**: 587-97, bibl. 36.

Some of the literature on the distillation of cananga oil is reviewed. Recent investigations show that ylang-ylang oil and cananga oil cannot be obtained from the same source. The trees supplying the two oils are botanically distinct and are now distinguished under the names *Canangium odoratum forma genuina* and *C. odoratum forma macrophylla* respectively. The photographs which illustrate the paper show the differences clearly. The properties of the oils are compared. It seems that though the preparation of ylang-ylang oil requires even more care than that of cananga, which is the Java product, it offers a better commercial prospect and should be worth growing.

269. SUCKLING, J. J. C. 633.821 : 581.162.3
 The cultivation and hand-pollination of vanilla.
Agric. J. Fiji, 1939, **10**: 42-3.

Planting distances for *Vanilla planifolia* Andr. are 8 × 8 ft. giving 680 vines to the acre. Living supports such as *Gliricidia* are to be preferred as they also supply shade. The aspect should be warm, humid, sheltered from wind and preferably on sloping land to ensure drainage. Propagation is by cuttings 4 ft. long planted two to each support with the base just covered by organic matter and the tops attached to the support. The flowers, which appear in 18 months, are hand-pollinated. The simplest way is by raising the stigma to the anther with a chip of bamboo and simultaneously pressing out the pollen. Five to six flowers only of each cluster are fertilized and the best results are obtained during the morning when the pollen sheds easily. About 200 flowers an hour can be fertilized. In 10 months the pod will begin to yellow and should then be picked to avoid loss from splitting. To cure the pods are placed for two hours a day in the sun, then brought in and wrapped in blankets, the process continuing for a month. The finished product should be dark and greasy to the touch and in colour dark chocolate. There is a demand for genuine vanilla despite the extensive use of the synthetic product.

* See *Annual Reports of Cacao Research, Cacao Research Scheme, Trinidad, 1931-37* and *Horticultural Abstracts* under one or other of these authors' names from 1932 onwards.

270. HUTSON, J. C. 633.83-2.76

A note on the cardamom weevil (*Prodiectes haemiticus* Chev. var.)

Trop. Agriculturist, 1939, 93 : 281-3.

The weevil is described and figured. The eggs are laid anywhere in the softer tissues of the plant and the grubs tunnel in the stems and rhizomes after riddling the plant from top to bottom. Symptoms of attack are the withering of the growing shoot. The only control measures recommended are the removal and burning of the infested plant. Whole clumps may have to be so treated. No pieces of rhizome or root should be left in the ground.

271. PAUL, W. R. C., AND FERNANDO, M. 633.842 : 581.084.2

Field-plot technique with chillies (*Capsicum annum* L.).

Trop. Agriculturist, 1939, 93 : 270-5, bibl. 7.

The results of a uniformity trial with chillies (*Capsicum annum* L.) carried out at the Experiment Station, Anuradhapura, during the *maha* season, 1938-9, are presented. The experimental field exhibited a pronounced fertility trend. Long, narrow plots elongated in the direction of the fertility trend, yielded the lowest errors. In well-oriented plots, the percentage standard error decreased with increase in size of plot. A plot size of 1/45 acre is recommended for field experiments with chillies. Information regarding the number of replications and the area of land necessary for demonstrating differences of a certain magnitude is provided. Small plots were more efficient in the use of land than large plots. [Authors' summary.]

272. THON, L. 633.85

Le sablier élastique (*Hura crepitans* L.). (The sandbox tree.) [Flemish summary.]

Bull. agric. Congo belge, 1939, 30 : 468-77.

The commercial uses of the seed of *Hura crepitans* L., the sandbox tree, a native of South America, are discussed. The possibilities for profitable cultivation in the Belgian Congo are not very great. The oil from the seed cannot be used as a foodstuff because of its purgative and possibly toxic qualities, nor for the same reason can the cake be fed to cattle. By reason of its low proportion of solid acids it is not suitable for use in the manufacture of stearine products. It saponifies easily but the soap is hard and suitable only for mixing with other fats. The oil is demi-siccative and unfit for greasing but has some value in the manufacture of such articles as linoleum. The cake is valuable for soil amendment, and this is its sole use. In South America *Hura crepitans* is used as a shade tree but the frequent falling of the brittle branches is liable to damage the under crop.

273. DE BELSUNCE, G. 633.854

L'oitica et son huile. (The oitica and its oil.)

Bull. Inst. colon. Marseille Mat. grasses, 1939, 23 : 197-202, bibl. 22.

The tree under discussion is *Licania rigida* Benth (*Rosaceae*) inhabiting the Amazon forests and the northern states of Brazil. The oil is obtained from the seeds and is used as a seccative in the paint and varnishing trade, for waterproof cartons and papers, etc. It is a possible rival to tung oil and for some work is to be preferred. It is now under experimental cultivation in U.S.A. The qualities of the oil and other points in connexion with its extraction are briefly mentioned and references are given to technical papers in which these matters are fully discussed.

274. CALVINO, M. 633.859.1

Una meliacea oleifera dell' Impero. (*Trichilia emetica* and its possible uses in the Italian Empire.)

Ital. agric., 1939, 76 : 305-11.

The author draws attention to the possibilities afforded by *Trichilia emetica* as a source of vegetable seed oil in the Italian colonies. Some dozen other species are known. It grows well in Portuguese West and East Africa in well drained soils below 2,500 feet. Reproduction is by

seed or root cuttings. The latter are made by taking pieces of root about a yard away from the trunk and not less than 5 cm. in diameter and cutting into pieces about 50 cm. in length. The cuttings are planted rather on the slant so that the larger part remains close to the surface where the oxygen of the air favours the formation of adventitious buds. Irrigation may be necessary for such cuttings. It is said, however, that plants thus vegetatively propagated are less resistant to hurricanes, at least in their earlier years. They should therefore be protected by wind breaks. The plant starts producing 6-8 years from planting and the cleaned seed contains 50% of oil. Lyne, late Director of Agriculture of Portuguese East Africa, reckoned that the value in oil seed produced should be very much more than that from coconuts. It also produces earlier, does not need so much cultivation, is much less trouble to pick and needs less processing than the coconut. The wood, with a weight of 600 kg. per cubic metre, is used for local joinery. Analyses of the oil are given here. That the plant has medicinal, possibly poisonous properties is known, but to what exactly they amount remains as yet uncertain.

275. ANON.

633.88.51

The world's cinchona bark industry.*Bull. imp. Inst.*, 1939, 37 : 18-31, 183-96.

The importance of making the British Empire self-supporting in the matter of quinine production is stressed. The Dutch East Indies produce nine-tenths of the world's supply of cinchona bark and this strong position is mainly due, apart from favourable climatic conditions, to the energy and systematic thoroughness displayed by the Dutch in the earlier days when other countries dealt with the cultivation but half-heartedly. The downfall of the industry in Ceylon was brought about largely by the discovery by the Dutch of the high quinine content of *Cinchona Ledgeriana*, on which plant they forthwith concentrated, while the Ceylon planters, continuing with the lower yielding *succirubra*, were driven from the market. Since then the quality of *Ledgeriana* has been continually improved by selection and breeding and problems of vegetative propagation, rootstocks, erosion and maintenance of soil fertility have been successfully overcome. The prosperity of the industry is now at its height, prices being maintained by co-operation between growers and quinine manufacturers. *India*. The need of increasing supplies of cheap quinine is urgent but it cannot be produced at prices to compete with the Java quinine. There are government plantations in Bengal and Madras but these will have to be considerably extended if the factory requirements are to be met. In Madras the cinchona grown is apparently *C. robusta*, while in Bengal it is *Ledgeriana* with small quantities of *succirubra*, *officinalis* and hybrids. *Tanganyika*. Cinchona appears to do well and attempts are being made by the Government to establish plantations. A hybrid, *C. Ledgeriana* × *C. succirubra*, has a quinine content equal to the best *Ledgeriana*. In Ceylon and Malaya attempts are being made to re-establish plantations, at any rate experimentally. At one time or another attempts have been made to grow cinchona in almost every country with a suitable climate. These each receive a brief note. All attempts seem to have lapsed either because the environment was not suitable or because the prices received were such as to render other crops more attractive.

276. RUBBER RESEARCH INSTITUTE OF MALAYA.

633.912-1.536

Planting without burning.*Plntrs' Bull. Rubb. Res. Inst. Malaya* 6, 1939, pp. 1-8, 5 cts.

The advantages of planting rubber without burning on forest land are many, the disadvantages have yet to be studied but none appear too serious. Methods range from planting in virgin jungle through various degrees in clearance to completely felling the jungle before planting. The latter method has been the subject of experiment by the R.R.I. in 1935 and is confidently recommended. The outline of the process is as follows. Contour strips 6-8 feet wide and 22 feet apart were cleared. All trees were then felled so as to fall along the cleared contour strips and so save subsequent removal. Stumps up to 10 inches diameter were moved along the cleared contour and piled with other litter between the lines. The contours were terraced and holed at 11 feet intervals. There was no burning. The jungle material between the

terraces was pruned to help it to settle and then left to rot. The large logs were pressed flush with the ground to prevent the earth washing out under them and other debris was pressed down to make it rot more easily. Except on the terraces, which were cleaned, weeded natural cover was allowed to develop and controlled by slashing to breast height at intervals of 4-6 months. So far growth of budded rubber has been satisfactory and there has been no soil loss by erosion. Possible economies when using this method are discussed. Disadvantages are danger of fire and increased damage by rats which last has to be combated by wire guards round the trees and by poisoning. Following up root disease is impossible until the felled jungle has rotted, after which it is easier than on land planted with a creeping cover. The routine inspections for root disease are easily made. The article concludes with practical notes by the Manager of the R.R.I. on the methods employed.

277. CRONSHEY, J. F. H., AND BARCLAY, C. 633.912-1.536

Replanting in areas infested by root disease. [English and Dutch.]
Arch. Rubbercult. Ned.-Ind., 1939, 23 : 163-6 (English), being *Contr. Plantation Res. Dep. U.S. Rubb. Plantations, East Sumatra*.

Clean weeded rubber, first recorded one year after planting, showed 9 months later an advantage of 3 cm. in mean girth over that in *Pueraria* cover. The *Pueraria* was kept 6 feet from the trunk. There was a slight difference in favour of trees on ground grub-hoed to a depth of 18 inches at planting. Planting the trees in holes (holing) 2' x 2' x 2' filled with good top soil gave an initial increase of growth but no further advantage. As regards root disease *Pueraria* markedly reduced losses, while stump pulling of the old remains of former rubber trees and deep hoeing in combination, but not separately, reduced losses by nearly half. Holing reduced losses by a quarter, being most effective in the first year. All these processes in conjunction reduced losses to one-seventh of those on untreated trees. They are not economic as regards growth effects only and should not be used unless root disease is prevalent.

278. RUBBER RESEARCH INSTITUTE, MALAYA. 633.912-1.541.11

Buddings and clonal seedlings.
Plntys' Bull. Rubb. Res. Inst. Malaya 2, 1939, reprinted from *Quart. Circ. Rubb. Res. Scheme Ceylon*, 16 : 32-40.

The new planting now allowed has again brought to the fore the very important question of whether to plant budded plants or clonal seedlings. The *pros* and *cons* are thoroughly discussed in this paper and the conclusion is reached that for the present budding from proved clones is best. The deciding reasons are that there are not enough proved legitimate clonal seedlings to provide for large-scale planting, that unproved clonal seed from isolated gardens presents a risk which it is safer to avoid, and that even legitimate seedlings are more variable than budded material and entail the trouble of weeding out the inferior types when tapping age is reached. With clonal budded material there is no likelihood of unpleasant surprises as no clone is recommended until it has survived the most exacting tests. Rootstocks raised from mixed clonal seed are to be preferred to stocks of unknown ancestry, provided the price of seed is reasonable. Clonal seedlings of Avros 163 and Bodjong Datar 10 are of particular value for stocks.

279. VOLLEMA, J. S., AND DIJKMAN, M. J. 633.912-1.541.11

Resultaten der toetsing van heveacloonen in den proeftuin Tjiomas-II.
(Results of the testing of hevea clones at the experiment station Tjiomas II.)
 [English summary 8 pp.]
Arch. Rubbercult. Ned.-Ind., 1939, 23 : 47-129.

The individual results obtained with 179 different clones are fully set out in a number of tables while the more important clones are further dealt with in the text as regards habit, bark renewal and bark diseases. Some general conclusions are as follows. The growth of seedlings and buddings remained parallel, though seedlings were always thicker at the foot than buddings of

similar age. Bark thickness increased with age but varied greatly with the different clones and in the case of buddings, but not of seedlings, remained practically uniform almost to the ground. The average bark thickness of the clones was the same as the average bark thickness of seedlings below 1.50 m. Strong growing clones generally have a thick bark. The yield of this garden far exceeded the official budding scale but few of the tested clones reached the yield limit of the best clones and some scarcely yielded at all in the first seven years, although the mother trees were high yielders. This is not to say that such clones will not eventually yield well. The early yield curves of the mother trees are not known. It must be assumed, of course, that a clone repeats the yield process of its parent and it should also be noted that a yield increase often occurs on renewed bark and on such bark the parent tree yields were recorded while the clones were tapped on virgin bark. Evidence that fast growing clones yielded more than slow growing clones was not forthcoming. There was great clonal variation in seasonal decrease in yield, some types showing none even in the dry monsoon. Wind damage proved formidable in the fourth to sixth years, decreasing with the closing in through growth of the plantations. Some clones showed great wind resistance. Wind resistance seems to be associated with the form of the tree and the structure of the wood. No connexion was found between yield capacity and susceptibility to panel diseases or between brown bast and panel diseases. There are important clonal differences in susceptibility to bark canker. Susceptibility to pink disease is greater in clones with heavy crowns. Continued vegetative propagation produced no ill effect.

280. VOGEL, J. 633.912-1.542 : 581.144.2
 Het bevorderen van de vorming van zijwortels bij *Hevea*-plantmateriaal.
 (Aids to the formation of lateral roots in *Hevea*.)
Bergcultures, 1939, 13 : 1458-9.

An account of a method of cutting the taproot of young *Hevea* some weeks before transplanting was abstracted in *H.A.*, 9 : 1420. Another pre-transplanting treatment, which diminishes loss and increases subsequent growth, is here described. It consists in removing the soil from the 1½-year-old plant to a depth of 20 cm. and cutting off all laterals close to the tap root. The stump is then completely ringed 3.4 cm. below the root crown and the soil replaced with the addition of a mulch drawn up round the stem for the sake of protection and to maintain moisture. The outward appearance of the tree remains unaltered. In 50 days the first new laterals appear as small protuberances on the taproot ; in 70 days the tree is making new root growth rapidly ; in 3½ months the taproot is fringed with a thick beard of young laterals. It is in this condition that the tree should be transplanted. The roots are plentiful but still short enough and supple enough to avoid damage. It has been found that these new laterals do not suppress the regrowth of the cut taproot.

281. RUBBER RESEARCH INSTITUTE OF MALAYA. 577.15.04 : 633.912
 Root stimulation by hormones.
Plntrs' Bull. Rubb. Res. Inst. Malaya 4, 1939, pp. 1-5.

Small-scale experiments in the treating of rubber stumps with growth substances prior to planting have resulted in early rooting and an increased number of roots on the part of the treated plants. Pending the results of large-scale experiments now in progress the following treatment is suggested. Remove all small lateral roots and cut back the larger roots to 3 inches. Trim the stem at the same time. Before treatment remove dried latex from the cuts. The stock top must be freshly cut before treatment to give an open end, or the root will not readily absorb the solution. Stand the cut ends of the taproots in a dilute solution of the growth substance (makers' recommended dilution) ; the solution need only be deep enough to cover the cut, say 1½ inches. The coagulating tank is suggested as a suitable container. After treatment wash the roots, dip the cut ends of the stem in grafting wax or white paint and plant out. The proprietary preparations Hortomone A and Seradix A are recommended as being available in Malaya.

282. WHELAN, L. A., AND DE SILVA, C. A. 633.912-1.8
Field experiments on Dartonfield Estate. VIII. Manuring experiment with mature rubber (1938).

Quart. Circ. Rubb. Res. Scheme, Ceylon, 1939, 16 : 12-8.

The results of a manurial experiment with mature rubber on the Dartonfield Estate show a slight improvement in yield in favour of the manured plots. This apparent response is at present to be treated with reserve. Absence of potash from a NPK fertilizer seemed to have a depressing effect on yield. The successful growth of *Pueraria* as a cover was restricted to plots treated with phosphate. Full details of quantities and mean plot yields are given.

283. RUBBER RESEARCH INSTITUTE OF MALAYA. 633.912-1.874
Organic manures—composts.

Plntrs' Bull. Rubb. Res. Inst. Malaya 5, 1939, pp. 1-5.

The advantages and the best method of constructing a compost heap on rubber plantations in Malaya is described. The compost heap, however, can never supply sufficient organic matter for a rubber estate and should be used rather as an adjunct to cover planting, the use of which is regarded as essential.

284. RUBBER RESEARCH INSTITUTE OF MALAYA. 633.912-1.874
Suggestions for the establishment of leguminous creepers under mature rubber trees.

Circ. Rubb. Res. Inst. Malaya 10, 1939, pp. 3.

Of the leguminous covers *Centrosema pubescens* and *Pueraria javanica* are particularly adapted in Malaya for cultivation under mature rubber trees to check erosion and to improve soil texture. Notes are given on propagation, time and methods of planting, and maintenance of the two most shade-tolerant creeping legumes.

285. MURRAY, R. K. S., AND DE SILVA, C. A. 633.912-1.556.8
Field experiments on Dartonfield Estate. IX. Comparison of tapping systems.

Quart. Circ. Rubb. Res. Scheme Ceylon, 1939, 16 : 47-63.

The results of the first two years of comparison of the relative merits of 11 tapping systems of *Hevea* in Ceylon are discussed. After the short time (2 years) that the experiment has been in progress a few general indications are :—Some benefit to the trees of the milder tapping systems ; the expected relatively high dry rubber content for third day tapping and the unexpected maintenance of a good figure for the double-three system ; a satisfactory d.r.c. from all systems ; no significant differences in bark renewal between the systems (this result should not be applied to less healthy trees or those showing for any reason a much slower bark renewal) ; an entirely satisfactory rate of bark renewal at the base of the trees with both single cut and double cut systems, but in this connexion the good condition of the trees and the excellent rate of renewal in the experiment area must be stressed ; a relatively large number of cases of brown bast under the double-three system.

286. GUEST, E. 633.912-1.556.8
I. The international notation for tapping systems and its use in the tabulation of yield records.

II. A standard international notation for systems of tapping hevea.

J. Rubb. Res. Inst. Malaya, 1939, 9 : 142-63, bibl. 7, and 164-70, being Communns R.R.I.M. 239, 240.

I. The development of the new international notation for tapping systems set forth in II (Communication 240) is explained. Objections to the old haphazard notations are mentioned and the importance of clearly defining tapping systems by standard symbols is stressed. Reasons are given for the subdivision of the notation under (1) number, (2) length and (3) type of cut, (4) frequency of tapping, (5) periodicity and (6) relative intensity. Further elaborations to deal with (7) change-over tapping are explained. Other factors which play a part in tapping are

mentioned, notably height of cut and bark consumption. Concise methods of recording them are suggested. Brief notes are given on the tabulation of yield records with special reference to the conception of tapping intensity. A broad classification of tapping systems is set forth on the basis of the factors symbolized in the notation.

II. Details are given of the new standard international symbols to represent tapping systems, together with examples of their use. (A full discussion of the reasons for introducing this standard notation, and of other related questions, forms the subject of I, Communication 239.) [From author's summary.]

287. MURRAY, R. K. S. 633.912-2.421.1
Oidium leaf disease in Ceylon in 1939.

Quart. Circ. Rubb. Res. Scheme Ceylon, 1939, 16 : 81-8, bibl. 3.

The local outbreaks of Oidium in Ceylon rubber plantations for the refoliation period 1939 are discussed. An unusual feature was the severe damage caused in certain districts despite very dry weather. The importance is stressed of starting the sulphur dusting programme before any appreciable fall of young leaf has occurred and of the necessity for maintaining an elastic rather than a hard and fast programme.

288. RUBBER RESEARCH INSTITUTE OF MALAYA. 632.954 : 634.993 : 633.912
Killing trees with sodium arsenite.

Plntrs' Bull. Rubb. Res. Inst. Malaya 5, 1939, pp. 6-7.

To kill trees other than those containing latex a frill is cut with an axe in the bark round the tree and a solution of 3 lb. sodium arsenite to 1 gallon of water poured in. Trees 18 inches in diameter require $\frac{1}{2}$ pint, the dose to be increased with size of tree. With rubber trees the latex coagulates and prevents the solution from entering. This is overcome by removing a 6 inch wide ring of bark round the trunk and, after the latex has ceased to flow, cutting a level channel about an inch deep round the tree in the exposed wood, the chisel being held at an angle of 30° to the vertical and care being taken to avoid cracking the edges of the channel. About $\frac{1}{2}$ pint of solution poured slowly into this channel is enough for the average rubber tree.

289. CALMA, V. C. 631.346 : 634.1/7
Studies on different containers for potting fruit plants.
Philipp. Agric., 1939, 28 : 583-92.

Comparisons were made between coconut husks, bamboo joints, a tin can and the ordinary clay pots as receptacles in which to grow pot plants. The coconut husks gave markedly better results than any of the others. When the husks were buried in the ground the plants in them were equally as vigorous as those growing alongside in the nursery beds. The husk possesses advantages in inarching, which is still the most usual method of grafting in the tropics, because it is lighter than an earthen pot, it can be easily hung on a tree and in any position, it can be easily watered with a hose and it absorbs and retains the moisture. Partially buried husks grew less vigorous plants than fully buried husks, but were still superior to all other receptacles. In transplanting the husk need not be removed and it enables the soil to be retained on the roots without trouble. It is, however, advisable to wrap it in a piece of sacking. Bamboo joints gave better growth than clay pots, possibly because of their greater depth. The plants used were various seedling tropical fruit trees. The sections of the coconut husks were held in place by wire, the clay pots had a top diameter of 7 inches, the tin was 6 inches across by 8 inches high, the dimensions of the bamboo are simply given as "regular". The work was done at the Philippine College of Agriculture.

290. SATTAR, A., AND MALIK, S. A. 634.441-2.41
Some studies of anthracnose of mango caused by *Glomerella cingulata* Stonem S. & V.S. (*Colletotrichum gloeosporioides* Penz) in the Punjab.
Indian J. agric. Sci., 1939, 9 : 511-21, bibl. 18.

The fungus causing anthracnose of mango has been identified as *Glomerella cingulata* Stonem S. & V.S. (*Colletotrichum gloeosporioides* Penz). It is pathogenic on the leaves, petioles, stems

and fruits. The optimum temperature for infection is 25° C. The effects of different environmental conditions and the mode of germination are described. The disease is perennial on diseased twigs, both fallen and on the tree. Control measures consist in burning all diseased material, treating the larger cut ends of branches with wound disinfectant and three sprayings (February, April, September) with bordeaux mixture 3:3:50. The investigations were carried out at the Agricultural Research Institute, Lyallpur.

291. WILLS, J. M. 634.57
The Queensland nut.

Qd agric. J., 1939, 52: 163-78, bibl. 7.

This paper contains one of the fullest accounts yet published of the commercial cultivation of *Macadamia ternifolia*, the Queensland nut. It is a pity that in the short bibliography of the literature, except in one case, date, volume and page numbers of the references are omitted, thus causing a great deal of needless trouble to the reader who wishes to consult them.

292. JONES, W. W. 634.57
A study of developmental changes in composition of the *Macadamia*.

Plant Physiol., 1939, 14: 755-67, bibl. 13.

The macadamia (*Macadamia ternifolia* F. von Mueller var. *integrifolia* (Maiden and Betche) Maiden) has recently become of considerable importance in Hawaii and knowledge is there being sought on the normal physiological development of this fruit with a view to improvement in cultural practice. The author summarizes his experiments as follows:—(1) A study was made of the physiological development of macadamia embryo. No chemical analyses are presented for any parts of the fruit other than the embryo, since preliminary work has shown very little change in the husk and shell except during early stages. (2) The development of the fruit is characterized by two distinct periods: the first is from flowering to the end of 90 days, during which very little oil is formed and the embryo does not enlarge sufficiently for analysis; the second is from 90 days to maturity, a period of about 125 days, during which oil is formed and the major expansion of the embryo occurs. (3) The total amount of sugar present increases during the early oil formation but decreases as maturity is attained. (4) Protein synthesis occurs during the same period as oil synthesis.

293. HARTUNG, M. E., AND STOREY, W. B. 634.57: 581.145.2
The development of the fruit of *Macadamia ternifolia*.

J. agric. Res., 1939, 59: 397-406, bibl. 8.

The result of an examination of fruit development in the macadamia grown in Hawaii (*M. ternifolia* F. Muell.) is summarized by the authors as follows:—Anatomical investigations indicate that the fruit of *Macadamia ternifolia* F. Muell. is a follicle and not a drupe. The pericarp is dehiscent along a single suture and is made up of a thick, leathery exocarp and a thin, soft endocarp. The so-called nut is a true seed having one seed coat that develops from the outer integument of the ovule, a hilum, and micropyle.

294. ANON. 634.575
The Brazil nut.

Bull. imp. Inst., 1939, 37: 350-8, bibl. 16.

Brazil nuts (*Bertholletia excelsa* Humb. and Bonpl.) are obtained almost entirely from the wild trees on the Amazon. The nuts are obtained from the fallen fruits by nomad labour, the employer paying about half the value of the nuts. Nuts not collected soon after falling begin to deteriorate. Grading of nuts for commerce is by size and district. The nuts should be fresh, this condition being indicated by the milky appearance of the cut kernel. Adulterations practised are the addition of old nuts or of the nuts of *Lecythis* spp., the monkey pot trees. The few trees in cultivation have usually borne first crops when 12 years old. In Malaya experimental plantings have not been very successful. Germination is slow and uncertain and attempts at vegetative propagation have not been successful. A note is given of the behaviour of trees growing in

various botanic gardens throughout the Empire. The species appears to be suited by the conditions in Seychelles and is now distributed by the Government nurseries as an economic plant.

295. VAN DER SLUYS, G. H. J. 634.6
Oil palm planting in Sumatra.

New Guinea agric. Gaz., 1939, 5 : 2 : 6-9.

The oil palms (*Elaeis guineensis*) in the Sumatra plantations of to-day, 150,000 acres, are all the descendants of the seed of four plants imported in 1848, two from the Hortus Botanicus, Amsterdam, and two from Bourbon. The progeny is very uniform, in contradistinction to the mixed types received in a recent importation from Africa. In Sumatra the tree will bear in 4 years from seed. Germination of seed is hastened by soaking the seed in hot water (115° F.) thrice daily for a few days. Germination takes from 4 to 8 months. The usual cover crops are used if no catch crop is being grown. The cost of developing and planting an estate is about £40 per acre. In Sumatra the profits range from £7 per acre for 5-year-old palms to £16 per acre in the tenth year, or on the expenditure mentioned a return of 15% in the fifth year rising to 40% in the tenth year.

296. DWYER, R. E. P. 634.61-1.4
Fall of mature coco-nut palms in New Guinea due to soil conditions.

New Guinea agric. Gaz., 1939, 5 : 1 : 19-31.

The study of soil profiles is recommended even if chemical data are not available when there is a question of the suitability of particular areas to coconut cultivation. Coconuts can flourish and yield normally with a very restricted rooting system provided the surface soil is physically and chemically rich. Some occurrences of the falling of healthy, mature coconut palms in New Guinea are associated with physical soil and subsoil conditions which vary somewhat with the district but are usually associated with shallow loose friable soil overlying a compact subsoil or the presence of a high water-table. These conditions tend to cause root restriction with the result that when the palms reach a certain height they are easily blown over.

297. FROGGATT, J. L. 632.76 : 634.61
The coconut leaf miner, *Promecotheca papuana*, Csiki (*antiqua*, Wse.).

New Guinea agric. Gaz., 1939, 5 : 1 : 3-10.

The biology and control of the coconut leaf mining beetle (*Promecotheca papuana* Csiki) in New Guinea are discussed. Mechanical control consists in cutting off and burning infested fronds : if cut carefully most of the beetles will come to the ground with the fronds. A method of scorching the undersides of the fronds with flares on poles is described. In low palms the egg masses can be rubbed off the leaves and adults collected and the larvae removed by crushing between the finger and thumb, so obviating the removal of the foliage. Beetles can also be attracted to young fronds, stuck in the ground, of sago and nipa palms (*Metroxylon Sagu* and *Nipa fruticans*) which can then be sprayed. Stomach or contact sprays can also be used. The best of these is arsenate of lead which remains toxic on the foliage for at least a week. Biological control is often very effective and if parasites are active other measures should not be taken. The parasites of *Promecotheca* in New Guinea, imported or indigenous, are described.

298. CHERIAN, M. C., AND ANANTANARAYANAN, K. P. 634.61-2.76
Studies on the coconut palm beetle (*Oryctes rhinoceros* Linn.) in South India.

Indian J. agric. Sci., 1939, 9 : 541-99, bibl. 24.

A life history of the coconut beetle, *Oryctes rhinoceros* Linn., under South Indian conditions at Coimbatore Research Station. Various control measures, none very satisfactory, are discussed. The most useful seem to be (1) the beetle rod, an iron rod 2½ ft. × ⅜ in. with a hook at one end and the other end bent to form a ring for a handle ; by its aid the adult beetle is hooked out of

its bore hole in the crown of the palm (the egg, larval and pupal stages are passed in the ground) ; and (2) infection with green muscadine fungus which in Ceylon is recognized as an effective means of checking the pest.

299. EASTWOOD, H. W.

634.771

Planting bananas.

Agric. Gaz. N.S.W., 1939, 50 : 613-4, 627.

Advice is given on the best method of planting bananas under New South Wales conditions. Large holes, not smaller than 15 inches in diameter and 15 inches deep, though more expensive to make, ensure that the sucker gets a good start. In excavating, the top 9 inches of soil are set aside and used for filling in around the sucker. When planted and trodden the sucker should be in a depression which gradually fills with hoeing and soil movement. On sloping ground the sucker is so placed that the following sucker or eye will be uphill. Planting distance is 12 × 12 ft. Double planting has not been successful hitherto because the two plants were placed too close together. To ensure success the two plants in each hole must be 2 ft. 6 in. apart, the hole must be large enough to accommodate them properly, and the suckers must be of equal sizes. Replacements seldom catch up with the original plants. In double planting only one follower should be allowed from each parent plant.

300. SUMMERVILLE, W. A. T.

634.771 : 581.144.2

Root distribution of the banana.

Qd agric. J., 1939, 52 : 376-92.

Three methods were used in the study of the root system of the banana in Queensland and are fully described. In two use is made of soil profiles. In the third a box with movable sides lined with paper mulch to prevent washing out, and provided with horizontal layers of 1-inch mesh wire netting stretched across at every 4 inches of depth, is constructed. Soil taken from an area the size of the box is replaced in the reverse order to which it was removed and the sucker planted in the centre. At the end of the determined growing period two opposite sides of the box are removed and the soil carefully washed out with a hose, using a low pressure of water. The washing operation on the occasion reported took ten hours' patient work. The only practical deduction so far possible is that the common practice of manuring close to the base has nothing to recommend it. Prolific root occurrence was found 4½ ft. from the plants in 9 × 9 ft. plantings. The number of feeding roots close to the plant is surprisingly small, the greatest density being at the ends of the main roots. Root hairs are microscopic and therefore unknown to many growers, but they are very numerous even on the main roots. In soils of open texture roots penetrate deeply and the banana responds easily to cultural methods designed to promote this desirable feature.

301. POPENOE, W.

634.771-2.48

Leaf spot of bananas.

J. Jamaica agric. Soc., 1939, 43 : 337-41.

The paper describes the onset of *Cercospora* leaf spot disease of banana in Jamaica. It was first reported (for Jamaica) in 1936, and it soon spread all over the island. The control of the disease lies in spraying with bordeaux mixture or other copper compounds which, until a system for the various local weather conditions has been evolved, should be at intervals of a few weeks throughout the year. Uninfected plantations need not be sprayed. Spraying should start when there is a light, scattered infection throughout a given area.

302. CAMARGO, F. C.

634.774

Ananás e abacaxi. (*Ananas* spp. and pineapple varieties.)

Rev. Agric., Brazil, 1939, 14 : 321-38, bibl. 20.

Some of the plants from the collection of *Ananas* (pineapple) species and horticultural varieties, which has been assembled at the Instituto Agronomico, Campinas, Brazil, during the past nine

years, are described and in some cases illustrated. The history of the variety is given when known. The object of the collection is to obtain a nucleus to provide material for hybridization and for botanical reference.

303. GREGORY, J. H. 634.771 : 664.85.771.036.5
Pineapples for canning.
Qd agric. J., 1939, 52 : 149-62.

An illustrated explanation is given of the reason why only pineapples of an even shape are suitable for the canning process. The different ways in which the various types of irregularity in fruit shape cause inconvenience and delay are described.

304. SIDERIS, C. P., KRAUSS, B. H., AND YOUNG, H. Y. 634.774-1.84
Distribution of different nitrogen fractions, sugars and other substances in various sections of the pineapple plant grown in soil cultures and receiving either ammonium or nitrate salts.
Plant Physiol., 1939, 14 : 227-54, bibl. 6.

Pineapple plants grown in non-sterilized soil cultures weighed more when grown in the cultures which received nitrogen in the form of ammonium salts than in cultures receiving nitrogen as nitrate salt. Notes are given of the respective chemical composition of different parts of the plant. The authors conclude from these and previous experiments that the chemical composition of plants grown in non-sterilized soil and receiving either ammonium or nitrate salts as a source of nitrogen varies very little owing to the conversion of ammonium to nitrate by the nitrifying bacteria of the soil.

305. SIDERIS, C. P., KRAUSS, B. H., AND YOUNG, H. Y. 634.774 : 612.014.44 : 581.192
Distribution of nitrogenous fractions, sugars and other substances in *Ananas* grown in darkness versus daylight.
Plant Physiol., 1939, 14 : 647-76, bibl. 9.

The various comparative results of growing pineapple plants in the light and in the dark are detailed. Two pairs of shoots obtained from two different mother plants were used. The two members of each pair were detached from the mother plants at the red bud stage. They were then allowed to root in solution cultures in the greenhouse. After this one of each pair was transferred to a dark box where it remained for the subsequent 4 months until ripe, while the other was kept in the greenhouse until ripe at the end of 5 months. The plants were weighed and analysed and the data are here discussed.

306. JEPSON, W. F., AND WIEHE, P. O. 634.774-2.752
Pineapple wilt in Mauritius.
Gen. Ser. Bull. Dep. Agric. Mauritius, 47, 1939, pp. 15, 25 cents.

Pineapple wilt was found in Mauritius in 1938 to be caused by *Pseudococcus brevipes* Ckll. Its summer and winter symptoms are described. The conclusion is reached that 4 or 5 applications of 1% diesel oil spray at 6-week intervals should suffice to prevent it. Alternative insecticides are diesel oil with triethanolamine oleate, kerosene-clay and nicotine soap. Hygienic precautions at planting will also help and the possibility of aid from the predatory coccinellid *Cryptolaemus montrouzieri* is noted.

307. GUATEMALA, DIRECCIÓN GENERAL DE AGRICULTURA. 634.774-2.4
Piñas enfermas en plantaciones de Santa Lucia Cotzumalguapa. (A pineapple rot.)
Rev. agric. Guatemala, 1939, 16 : 119-20.

A fungal rot of pineapples attributed to *Thielaviopsis ethacetica* is described and illustrated. Symptoms are rotting, an apparently bruised surface and later the development of black fungal blotches. The disease is serious, since it may also attack sugarcane. It is spread through the

seed. It can be combated by seed selection and seed disinfection. The latter is secured by soaking the seed for 20 minutes in a formalin solution of 1 lb. to 15 gallons water, by burying diseased fruit in deep trenches after treatment with bordeaux mixture or with lime, by using a knife blade dipped in a formalin solution when harvesting and by leaving the pine after cutting with a short length of peduncle, attached crown downwards, in the sun for an hour to dry it.

308. PIERIS, H. A. 635.348

Cultivation of knol khol in the Hanguranketa district.

Trop. Agriculturist, 1939, 93 : 30-2.

Brassica caulorapa, or kohl-rabi, is a crop admirably suited to districts with a cold dry climate and a heavy loamy soil well supplied with humus such as is found in certain highland districts in Ceylon. Cultural directions are given. A reason for the crop's growing popularity in Ceylon is the fact that owing to its keeping qualities it need not be sold hurriedly to the first buyer as in the case of more perishable vegetables.

309. HAIGH, J. C. 635.655

Trials with soybean in Ceylon.

Trop. Agriculturist, 1939, 93 : 144-56, bibl. 13.

Spacing. Of two spacings (1' × 6" and 1' × 1') the narrower is to be preferred, since it gave the bigger yield. *Inoculation*. This trial is the only one in Ceylon in which inoculation of seed has given a definite increase in yield but the size of the difference entitles it to some consideration. *Manuring*. (1) Nitrate of soda at the rate of 1 cwt. per acre and (2) lime at the rate of 1 ton per acre had each produced a small, and, in the case of the nitrate of soda, significant increase. *Interaction between inoculation and spacing*. Inoculation effects were more marked with the narrower spacing. *Interaction between inoculation and manuring*. The effects of manuring with nitrate of soda and inoculation appear to be antagonistic but the effect of inoculation is the stronger. There were varietal differences in reaction to most of the experiments.

310. CAMPBELL, I. W. 668.533.2

The cultivation and distillation of lemon grass in Travancore.

Bull. imp. Inst., 1939, 37 : 365-7.

The cultivation of lemon grass in India is now restricted to remote country districts in Travancore State at about 500 ft. above sea level. The soil may be anything from rich loam to laterite ; the more fertile the soil the lower the citral content and the higher the yield, while on the laterite soil the effect is the opposite. The life of the plant is from 6 to 15 years, it is productive for about 10 years with highest yield period from second to sixth years. The grass is cut when 4 feet high. The part containing the oil is the round stalk at the foot of each blade in the heart of the clump. The highest oil content is found during dry weather. The first cut may be made 6 or 7 weeks after sowing. In established plantations four cuttings a year are usual. The distillation process described is very primitive. The price is now extremely low, having dropped from 4s. 6d. per lb. c.i.f. London in 1934, to 1s. 4½d. in 1939.

311. WORSLEY, R. R. LE G. 668.533.2

Experimental lemongrass plots in Amani.

Bull. imp. Inst., 1939, 37 : 180-2.

Experimental plots of *Cymbopogon citratus* Stapf at Amani at two planting spacings showed that close planting 9 × 9 inches was more advantageous than wide spacing 3 × 3 feet. The citral content of the oil appeared to be positively correlated with the rainfall.

312. HAIGH, J. C. 668.64

Gums and resins.

Trop. Agriculturist, 1939, 93 : 217-18.

A note on the wild or common trees of Ceylon which might prove a useful source of gums and resins.

313. BURMA, DEPARTMENT OF AGRICULTURE. 658.8 : 63
Trade in agricultural products, 1934-35 to 1936-37.
Markets Section Bull. Dep. Agric. Burma, 1A, 1939, pp. 11.
Discrepancies in market prices. 658.8
Markets Section Bull. Dep. Agric. Burma 2, 1939, pp. 8.
Marketing improvement. 658.8
Markets Section Bull. Dep. Agric. Burma 3, 1939, pp. 9.
 BURMA, DEPARTMENT OF AGRICULTURE. 633.71
Tobacco.
Markets Sect. Survey, Dep. Agric. Burma, 1, 1939, pp. 41.
Linseed. 633.854.54
Markets Sect. Survey, Dep. Agric. Burma, 3, 1939, pp. 11.

STORAGE.*

314. TODHUNTER, E. N. 634.11 : 577.16
Further studies on the vitamin A and C content of Washington grown apples.
Bull. Wash. St. agric. Exp. Stat. 375, 1939, pp. 24, bibl. 23.

A study at the Washington agricultural experiment station of factors that might affect the vitamin A and C content of apples has been carried a step further. In present experiments both the biological method and chemical titration were used to measure vitamin C. There was no increase in vitamin C content or nitrogen in Winesap apples from plots receiving additional N, P and K. There was no significant difference in vitamin C content of the highly coloured apples and the poorly coloured apples of Jonathan and Delicious varieties from the same trees. Several varieties of apples were found to show a difference in vitamin C content per gram of apple, e.g. Esopus (Spitzenburg) contained 2.0 international units, Winter Banana 1.0, Stayman Winesap 0.9, and White Winter Pearmain 0.6. The vitamin C was found to be unevenly distributed throughout the fruit. No difference in vitamin C content was found in Rome Beauty apples receiving two different irrigation treatments. On the other hand the Winesap apples receiving 60 inches water per acre appeared to be higher in vitamin C than the fruit from plots receiving half the amount of irrigation water. The peel of the Richared apple contained five times as much vitamin A as the flesh. Delicious apples contained approximately 102 international units per 100 g. fruit.

315. DREOSTI, G. M., AND WISSING, P. 631.564 : 634.1/8 and 664.85.037
The cooling of fruit.
Rep. Low Temp. Res. Lab., Capetown, for the year June 1937 to June 1938, 1939, pp. 233-41.

The preliminary results reported in the Annual Report for 1933, in connexion with single tiers of fruit packages, have been confirmed and extended. It is shown that at the centre of the tier, the provision of cleats is more important than additional openness of peach packages. The value of slotting the paper liners in plum and pear packages has been confirmed, the cooling being twice as fast as with completely lined packages—thrice for double layer plums—due to facilitating the circulation of cold air through the packages. Similarly the fruit-air temperature differences within the packages show that penetration of cold air plays an important part in the cooling of woodwool-lined packages. The fastest cooling positions are generally the corners, in the case of trays, and the upper edges in the case of multiple layer packages; particularly on the bulge side for pear boxes. The centre is the slowest cooling position. The order of cooling for the different fruits is :—peaches, single layer plums, grapes, double layer plums, and pears. The effect of air velocity is generally more pronounced at the top of the tier (except peaches); for shallow packages the effect is greater for centre fruits in the packages, whilst for deeper packages it is greater for side fruit. [Authors' summary.]

* See also 70.

316. PIMENOVA, A. S., AND MYAZDRIKOVA, M. N. 664.84.13 : 632.952
Professor Zbarsky's bactericide* for the control of diseases of vegetables in storage. [Russian.]
Vegetable Growing, Moscow, 1939, No. 8, pp. 42-5.

In experiments conducted in 1938-9 by the Principal and Moscow Commercial Centres for Fruits and Vegetables, Professor Zbarsky's bactericide used at the strength 1 : 10,000 gave the most satisfactory control of sclerosis of carrots in storage. The bactericide was particularly effective when carrots were submerged in it. Spraying with equally strong solution was also satisfactory, though less effective, but it is said to have certain advantages over submersion. In experiments with cabbage the bactericide used at 1 : 5,000 reduced considerably the development of botrytis rots during storage and resulted in some 20% increase in healthy, first-rate heads. However, in the case of cabbage dusting with chalk (2·5-3% of the weight of the cabbage) gave better results, the loss of cabbage leaves during storage was almost halved and there were obtained some 30% more first-rate heads, the principal losses during storage occurring among the poorer quality heads (thirds).

317. SHAFIK, M. 632.944 : 664.8
A study of some mixed fumigants suitable for the control of stored products insects.

Bull. tech. sci. Serv. ent. Sect. Minist. Agric. Egypt **227**, 1938, pp. 160, P.T. 30.

The first of the three sections of this paper deals with the partial vapour pressures at 25° C. of the binary mixtures selected. The technique worked out for determining these by means of a bubbling method is fully described. It includes several new features. The second section deals with the inflammability of the vapours of the mixed fumigants. The lower inflammability limits are determined by a modification of the standard method. The last section considers the toxicity of the fumigants to all stages of *Ephestia kuehniella* Zell. bred under particular conditions. The experiments involved the construction of a special chamber. The results place the fumigants in a certain order of toxicity and reveal their specificity for different stages in the insect's life. [From author's abstract.]

318. ISAAC, W. E., AND BOYES, W. W. 664.85.11.038 : 632.19
Storage tests with Wemmershoek and Rome Beauty apples with special reference to superficial scald.

Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 117-26, bibl. 3.

Superficial scald was eliminated for practical purposes in Rome Beauty apples stored at 31°, 34° and 37° F. by oiled wrappers and was reduced in Wemmershoek apples, though with the latter they were less effective at 31° F. than at 34° and 37° F. The incidence of the phenomena of scalding varied considerably in the two varieties and also according to temperature of store.

319. HULME, A. C. 664.85.11 : 581.192
The alcohol-insoluble (protein) nitrogen fraction of the apple fruit.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 125-7.

The author describes in detail a scheme for removing the crude protein from apple tissue. Briefly, it consists of first removing as many unwanted substances as possible from the tissue and then extracting the protein.

320. HULME, A. C., AND SMITH, W. H. 664.85.11 : 581.192
A relationship between protein content and rate of respiration in the cell of the apple.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 127-8, bibl. 3.

The establishment of a relationship between protein content and rate of cell respiration in the Bramley's Seedling apple confirms the view that cell multiplication in a normal crop of this

* See also H.A. 8 : 1262.

fruit practically ceases at an early stage of the fruit's development, i.e. in the experiments described here before picking the first sample on 11 June.

321. KIDD, F., AND WEST, C. 664.85.11.035.1
The production of volatiles by apples. Effects of temperature, maturity, technique of estimation, etc.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 136-9, bibl. 2.

The technique of estimation of volatiles in stored apples in terms of carbon is described. In an experiment with Chiver's Seedling apples no evidence was forthcoming that such accumulations of volatiles and of carbon dioxide as may normally be met with in ordinary storage or in cold storage depress the production of volatiles. Experiments with Bramley's Seedling apples suggest that the production of volatiles may be higher at mean or low temperatures than at higher temperatures.

322. KIDD, F., WEST, C., AND HULME, A. C. 664.85.035.1 : 581.192
Rise in insoluble ("protein") fraction of the total nitrogen during the climacteric in apples and pears, and effect on this phenomenon of retarding the climacteric by carbon dioxide or stimulating the climacteric by ethylene.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 119-25, bibl. 6.

Experiments with Conference pears show that whereas in pears, as in apples, the total nitrogen remains approximately constant during storage life, the alcohol-insoluble fraction of total nitrogen (the "protein" fraction) increases as the respiratory activity rises at the climacteric of ripening. Further it is shown that in air this protein nitrogen increases at the expense of soluble nitrogen during the climacteric rise in respiratory activity. When the climacteric is delayed by carbon dioxide the rise in protein nitrogen is also delayed. These and other observations on ethylene-treated Bramley's Seedling apples demonstrate strikingly the parallelism between the respiration-climacteric and the increase in protein nitrogen, whether the climacteric is induced by ethylene or occurs normally.

323. KIDD, F., AND WEST, C. 664.85.11.035.1
The gas storage of Cox's Orange Pippin apples on a commercial scale.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 153-6, bibl. 3.

Cox's Orange Pippin apples were picked, transported about 70 miles and put in gas store at Ditton within $3\frac{1}{2}$ days of picking, in an atmosphere containing 5% CO_2 + $2\frac{1}{2}$ % oxygen at 39° F. The fruit was wrapped in oil wrappers and kept in approx. bushel orchard boxes. The store was sealed on 25 September and was opened again on 22 February 1938. The fruit was compared with similarly wrapped control fruit stored in cabinets at 39° F. (1) in air, (2) in an atmosphere containing 5% CO_2 + 16% oxygen and (3) in an atmosphere identically the same as the store, but obtained by the "continuous flow" method. The fruit stored in the now approved mixture of 5% CO_2 and $2\frac{1}{2}$ % oxygen compared advantageously with that stored in either of the other atmospheres. On 9 March samples were removed to ripen at 65° F., 60°, 50° and 39° F. Room temperature, 60° F., resulted in sweet, juicy, good flavoured fruit. The fruit thus ripened remained marketable for about 2-3 weeks after removal from store. A ripening temperature of 39° F. gave sweet, crisp, juicy fruit of fair to good flavour which remained marketable for 7 weeks after removal from store.

324. HEALD, F. D. 664.85.11 : 632.4
Control of rots of apples.

Pop. Bull. Wash. St. agric. Exp. Stat. 158, 1939, pp. 8, bibl. 16.

Control measures under Pacific Northwest conditions against the blue and grey moulds, black rots and anthracnoses which cause the decay of apples in storage or in transit to market are here outlined.

325. HORNE, A. S., AND TOMKINS, R. G. 664.85.11 : 632.4

The relation between resistance, mortality and spore load.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 171-3, bibl. 3.

A report on further observations on the incidence and susceptibility to fungal invasion of apple samples from the West of England, Kent and Fen districts. The order of susceptibility to wastage in storage was Kent, West and Fen.

326. HORNE, A. S. 664.85.11 : 632.4

The resistance of the apple to fungal invasion.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 173-83.

Resistance influenced by locality. Penetration of *Botrytis* and *Penicillium* via lenticels into Bramley's Seedling apples showed again (see *H.A.*, 8 : 1275) an appreciably higher percentage in those from Kent than in those from Ulster. Penetration via punctures was universal in Kentish apples and 87.3% in Ulster apples. As regards radial advance of infection results again show higher values for Kent, indicating the higher internal resistance of Ulster fruits. Natural spotting was lower in both localities than in the previous year, but again higher on Kentish than on Ulster fruit.

Resistance in relation to injection. Trees were injected with various nutrient solutions in their off and their on years and observations made of the effect, if any, on resistance. From the extremely numerous data given the author cites among others the following indications :— (1) A tendency of fruits from trees injected in their on year to offer greater resistance than those from trees injected in the off year. (2) A tendency for Bramley's Seedling apples from trees injected with N to be especially susceptible. (3) A tendency for Boscombe Mystery apples from trees injected with N to be more resistant. Other indications are more dubious.

327. VAN DER PLANK, J. E. 664.85.13.037

Delayed storage and conditioning of Bon Chrétien pears as aids to ripening at 45° F.

Rep. Low Temp. Stat. Lab., Capetown, for the year June 1937 to June 1938, 1939, pp. 28-50, bibl. 4.

Delayed storage at warm temperatures, 65° F. and 75° F., was tried in 11 consignments of fruit as a method of partially ripening to facilitate the subsequent completion of ripening at winter warehouse temperatures, of which 45° F. was taken as typical.

Notes are given of the pressure changes, measured by a Magness-type penetrometer, in fruit held loose in open trays at 75° F. after picking. When held loose at 65° F. fruit showed the same tendency as at 75° F. towards a long interval between picking and softening, the rate of softening being slightly slower than at 75° F. The standard deviation showed the same rise to a maximum with an eventual fall in value, and, although the value at the maximum was less than at 75° F., it was still too high for practical purposes.

Packing the fruit in standard boxes prior to holding at 75° F. resulted in hastening the rate of softening and the standard deviation remained sufficiently low for practical purposes throughout. Fruit, after a delay at 75° F., insufficient to cause softening by itself, exposed to 34° F. softened only very slightly. But where the delay at 75° F. was long enough to cause rapid softening, softening continued after cooling. However, cooling to 34° F. in such cases checked softening sufficiently to indicate that fruit could probably be successfully shipped at 34° F. after suitable, delayed storage. Conditioning at 75° F. following cold storage resulted in fast, consistent ripening and uniformity of ripened product. Fruit cooled after picking without delay to 34° F. generally failed to give a satisfactory product on subsequent ripening at 45° F. The most successful product showing uniformity, full flavour, texture and colour, was got by packing fruit and giving a short exposure to 75° F., then storing at 34° F. and subsequently ripening at 45° F. There was no evidence to show that storage at 34° F. for 3 weeks had any bad effect on fruit thus previously part-ripened by delayed storage.

328. KIDD, F., WEST, C., GRIFFITHS, D. G., AND POTTER, N. A.

664.85.13 : 581.192

Sorbitol in pears and its conversion during storage into fructose units.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 132-6, bibl. 15.

The methods of isolating, identifying and estimating the amount of sorbitol present in the alcoholic extract of stored apples or pears are described in detail. The decrease in amount of incompletely characterized alcohol-soluble fraction containing sorbitol during storage of pears is compared with the gain in fructose units over the same period and is plotted graphically.

329. KIDD, F., AND WEST, C.

664.85.13.035.1

The rate of respiration and production of volatiles of Conference pears : effects of treatment with ethylene, temperature and wounding.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 139-42, bibl. 2.

Studies are reported on the effect on the production of volatiles in pears of (1) ethylene stimulation, (2) cutting into pieces, (3) temperature. The production of volatiles was found to run parallel with respiration activity. A two-day application of ethylene immediately after picking caused a reversible increase in rate of respiration and later an early climacteric rise. A three-day application of ethylene two weeks after picking caused the immediate onset of the climacteric and a corresponding rise in the rate of production of volatiles. The effect of cutting the pears into eight pieces was to cause an earlier rise in the rate of production of volatiles, the greatest production being about the same as in the ethylene-stimulated fruit. As regards temperature there was little difference at any temperature between 15° C. and 1° C. in the time elapsing after picking before the rate of production of volatiles began to rise, i.e. about 35 days. The time taken to reach the maximum rate, however, was markedly affected by temperature, varying from 7 days at 15° C. to more than 80 days at 1° C.

330. KIDD, F., WEST, C., GRIFFITHS, D. G., AND POTTER, N. A.

664.85.13.037

An investigation of the changes in chemical composition and respiration during the ripening and storage of Conference pears.

Ann. Bot., Lond., 1940, 4 : 1-30, bibl. 27.

The investigation reported here was carried out by the Cambridge Low Temperature Research Station on Conference pears harvested at three stages of maturity in August and September 1936. The subsequent respiratory activity of the fruit is here discussed in relation to the observed chemical changes. The authors summarize as follows:—" . . . The curves for respiratory activity (expressed as rate of CO₂ production per unit fresh weight) are essentially similar to those for apples. They show, after gathering, an initial falling rate. At maturity the rate begins to increase (the climacteric rise), the extent of the rise eventually being of the order of a 2- to 3-fold increase. The climacteric rise is followed by a final rise and fall, the final rise being accompanied by the breakdown of the flesh of the fruit. The final fall in rate, which, in the absence of fungal infection, would probably reach zero activity, is associated with the death of the tissue. The rate of production of carbon from volatile substances (other than CO₂) showed an approximately 10-fold increase during the course of the climacteric rise in respiratory activity. During the subsequent phase of breakdown of tissues a marked falling off in rate was observed. There was no evidence that the volatile substances were predominantly alcohol or aldehyde. In the pre-storage drift on the tree the respiratory activity of the fruit is very closely correlated with the content of protein nitrogen and of acid. In the storage drifts the climacteric rise is probably accompanied by a rise in (i) the ratio of protein nitrogen to alcohol-soluble nitrogen and in (ii) the absolute amount of cane sugar. During storage there is a marked decrease in the unestimated fraction and an almost equivalent increase in fructose units. The unestimated fraction is approximately 4% of the fresh weight. About half this fraction consists of sorbitol, and the decrease during storage can be accounted for by the loss of sorbitol. In discussing the relation of the respiratory activity of the fruit to the observed chemical changes, attention has been concentrated on the carbohydrate changes since the acid content is very small. These

changes have been interpreted as being the result of (i) a respiratory drain on the glucose units throughout ; (ii) a supplementary drain on fructose units during the post-climacteric phase ; (iii) the formation of glucose units or of units estimated as glucose, from the alcohol-insoluble residue, and (iv) the formation of fructose units from glucose units during the hydrolysis of starch."

331. GANE, R. 664.85.13.035.1 : 664.85.771

The production of a physiologically active vapour by unripe pears.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 142-3.

Williams pears when hard and green, stored at 0° C., were found to evolve a vapour which caused ripening in bananas.

332. KIDD, F., AND WEST, C. 664.85.13.035.1

The gas storage of English grown Doyenné du Comice pears.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 157-60.

Comice pears gathered hard, in the pre-climacteric condition, on 27 September 1937 were stored unwrapped at once at 31·5° F. and at 34° F. in atmospheres containing the following mixtures :— O₂ 21%, CO₂ nil ; O₂ 16%, CO₂ 5% (at 34° F. only) ; O₂ 10%, CO₂ 10% ; O₂ 5%, CO₂ 5% ; O₂ 5%, CO₂ 10% (at 34° F. only) ; O₂ 2·5%, CO₂ 5% ; O₂ 2·5%, CO₂ 10%. Samples were removed to ripen at 50° F. and at 65° F. on 24 November, 3 January, 25 February, 1 April, and 26 April 1938. Fruit ripened satisfactorily at both temperatures. The lower storage temperature, 31·5° F., gave the best results and of the atmospheres 2·5% O₂ + 10% CO₂. The storage life was not so long as that got in previous years with Conference and Williams. The maximum in gas store was about 5 months, however, as against 4 months in air store. Gas-stored fruit showed the further advantage over air-stored of taking 12 days to ripen at 65° F. as against 6 days in the case of air-stored fruit. The end of storage life was marked by the development of brown heart. Some of the gas-stored fruit ripened green and such fruits did not have such a pronounced pear flavour and aroma as the air-stored fruit or the gas-stored fruit which ripened yellow.

333. HANSEN, E. 664.85.13.035.1 : 547.313.2

Effect of ethylene on certain chemical changes associated with the ripening of pears.

Plant Physiol., 1939, 14 : 145-61, bibl. 27.

Experiments with Bartlett and Anjou pears from the Hood River and Medford (Oregon) districts show that ethylene treatment applied at certain stages increases in them the rate of starch digestion, the concentration of total and reducing sugars and the transformation of protopectin to pectin. No changes in titratable acidity were observed. It was found that the increase in rate of softening in ethylene-treated pears is correlated with an increase in rate of pectin changes. The response to ethylene varied with the maturity of the fruit and with the length of storage prior to treatment. Thus pears picked at an early stage of development ripened readily under treatment, whereas similar fruit not so treated failed to ripen or was markedly delayed in ripening. In pears collected more mature, ripening changes proceeded more rapidly and the effect of ethylene was, therefore, less pronounced. After pears had been held in store for comparatively short periods of time the chemical changes resulting in ripening occurred very quickly on removal of the fruit to a higher temperature and there was little if any benefit from ethylene. The length of time during which the individual chemical ripening changes are influenced by ethylene varies greatly, being shortest with sugar and starch changes and longest with pectic reactions and respiration.

334. SMITH, W. H. 664.85.22.035.1

The artificial ripening of Monarch plums.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 165-9, bibl. 2.

Data are given of observations on the effect of exposure of Monarch plums to acetylene on the first or second day after picking, to acetylene and ethylene after low temperature storage for

varying lengths of time and to acetylene and ethylene prior to removal from low temperature storage. Immature plums treated immediately after picking at 18.3° C. with acetylene ripened faster and more uniformly and developed a more pronounced flavour than untreated fruit. After storage for 3 weeks at low temperatures stimulation of ripening was still possible on removal to 18.3° C. with acetylene, with ethylene and with air that had passed over ripe plums.

335. DAVIES, R., BOYES, W. W., AND DE VILLIERS, D. J. R. 664.85.22.037

Storage of plums.

Rep. Low Temp. Stat. Lab., Capetown, for the year June 1937 to June 1938, 1939, pp. 13-28.

Santa Rosa plums were stored successfully at 45° F. and 48° F. for 25 days and gave a good product, provided ripening was completed in 10-15 days afterwards. Picking at a later stage than is normal would considerably increase weight of final products. Gaviota plums developed abnormal ripening at 48° F. The ripest stages at 45° F. also showed a tendency to bladderness on ripening.

Kelsey plums showed great susceptibility to low temperature injury and nearly all fruits stored at 34° F. were quite unusable on that account. The ripest stages stored at 48° F. were relatively free from this injury. Pitting was severe and must be considered a major factor in storing Kelseys. There was again evidence of abnormal softening at 48° F. in this variety. There was no confirmation of previous indications that pre-storage treatment of Kelseys with CO₂ assisted colour production and ripening after storage. No advantage was apparent from storage of Kelseys in super-atmospheric concentrations of oxygen.

Wickson plums proved very susceptible to low temperature injury and in addition showed high incidence of internal breakdown at 45° F. and 48° F.

336. HANES, C. S., AND MORRIS, T. N. 664.85.22

Transformation of pectic constituents of plums during normal and abnormal ripening.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 129-32, bibl. 1.

Investigations with Victoria plums picked at three stages of maturity and subjected in storage to various known temperatures show that the soluble pectin of plums normally becomes much less viscous in character when the fruits pass from the immature to the mature stage, either attached to the tree or in storage at temperatures at which normal ripening occurs. When, however, immature fruits are subjected to low temperatures so as to lead ultimately to more or less severe metabolic disturbance, the capacity to induce this change in the soluble pectin is lost. This accounts for a type of low-temperature injury in plums picked immature in which the flesh develops an abnormally gelatinous consistency and an injected transparent appearance.

337. ISAAC, W. E. 664.85.22 + 664.85.25

Investigations on the active substance produced by peaches and plums.

Rep. Low Temp. Res. Lab., Capetown, for the year June 1937 to June 1938, 1939, pp. 93-116, bibls. 8 and 6.

I. *Evolution of a growth inhibiting substance at 35° F. and 50° F. from Peregrine and Elberta peaches and Santa Rosa and Kelsey plums.* The plants used for the tests were sprouting potatoes (variety Up-to-Date), sweet pea seedlings, garden pea seedlings and dwarf bean seedlings. The growth phenomena exhibited by these plants in the presence of the ripening fruit allows of the general conclusion that ethylene is evolved from Santa Rosa plums and Peregrine peaches at both 35° F. and 50° F., from Elberta peaches at 35° F. and from Kelsey plums at 50° F. Results with one or two exceptions were somewhat less pronounced than in the previous year. In a number of cases the experimental plants showed no clear evidence of ethylene evolution from the tested fruit. The cases of no or little response are grouped according to the maturity of the fruit at particular temperatures.

II. *The use of epinastic curvatures of leaves and of the reactions of the "sensitive plant" to detect the presence of ethylene.* The conclusion reached that at ordinary temperatures the Kelsey plum

evolves much less ethylene than the other varieties tested received confirmation from experiments in which the sensitive plant (*Mimosa pudica*), the African marigold (*Tagetes erecta*) and the potato plant were used as indicators. The young potato plant proved the most sensitive.

338. SMITH, W. H.

664.85.22

Physiological breakdown in Monarch plums.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 148-53, bibl. 2.

Monarch plums of varying noted ripeness were stored at 65° F., 50°, 45°, 40°, 37°, 34° and 31° F. Samples were removed every 7 days and examined. It was evident that there must be a critical temperature between 50° F. and 65° F. below which some of the plums would not ripen, the proportion increasing rapidly the lower the temperature. Instead of the normal ripening changes certain abnormal changes occurred consisting of jellying of the flesh without juice formation and internal browning. Delaying storage merely increased the incidence of physiological breakdown. The conclusion is reached that the storage life of Monarch plum is very limited. Storage in air at 34° F. appeared to be best and a life of one week for plums more than three-quarters coloured and two to three weeks for less mature plums is indicated.

339. SMITH, W. H.

664.85.22.035.1

The gas storage of Monarch plums.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 161-5.

Monarch plums were stored at 45° F., 37° F. and 31° F. in atmospheres as follows:—(1) air, (2) O₂ 21%, CO₂ nil; (3) O₂ 18.5%, CO₂ 2.5%; (4) O₂ 16%, CO₂ 5%; (5) O₂ 5%, CO₂ 2.5%; and (6) O₂ 5%, CO₂ nil. At all temperatures there was a reduction in physiological breakdown and in rots in mixtures 5 and 6 compared with these phenomena found in air-stored fruit.

340. TINDALE, G. B.

664.85.22.037

Victorian plums and peaches: cool storage and export.

J. Dep. Agric. Vict., 1938, 36: 609-20, bibl. 4.

The behaviour of Victorian plums and peaches in cold storage is discussed. Mature plums can be kept for a considerable time by first storing at 32° F. and then transferring to the minimum ripening temperature which varies from 40° F. to 46° F. according to variety. The storage life was greater than could be obtained by the use of either temperature alone, varying from 8 weeks with the Satsuma plum to 18 weeks with Coles Golden Gage. Similar results were obtained with peaches, the minimum ripening temperature varying from 45° F. to 55° F. according to variety. Control of fungal rotting of peaches is only obtained by reducing infection in the orchard. At 45-55° F. peaches are fully ripe when they have reached the climacteric of respiration, but plums do not become fully ripe till much later. The storage life at 32° F. is not more than half the time necessary to reach the climacteric.

341. DAVIES, R., BOYES, W. W., AND DE VILLIERS, D. J. R.

664.85.25

Storage of peaches.

Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 51-3.

Peregrine peaches were subjected to periods of delay varying from 1 to 12 days between picking and storage at 75°, 65° and 50° F., before being stored at 34° F. for 25 days. Results agreed with those previously published. For fruit of similar maturity 2.5 to 3 days delay at 75° F. were needed to eliminate all but very slight traces of woolliness. With a day temperature of 65° F., 4-5 days eliminated it completely, while 10 days were needed at 50° F. to produce even moderate control. Ripening was carried out at 45° F. and under these conditions the best results were got from delaying at 65° F. Fruit delayed 4-6 days at 65° F. was in excellent condition 5 days after removal from store. The effect of delayed storage was not so great in Elberta as in Peregrine peaches.

342. HALLER, M. H., AND HARDING, P. L. 664.85.25

Effect of storage temperatures on peaches.

Tech. Bull. U.S. Dep. Agric. 680, 1939, pp. 32, bibl. 22.

The storage work reported extended over four seasons and concerned chiefly the peach varieties Carman, Belle of Georgia, Elberta and J. H. Hale. The fruit was picked "shipping ripe" and stored the same day or the following morning at the following temperatures:—80° F., 70°, 60°, 50°, 40°, 36°, 32° and 30° F. The effect of temperature on softening, respiration, composition, storage life and dessert quality was noted and is here discussed. Results indicated that peaches cannot be held in store longer than 2 to 4 weeks according to variety and growing conditions without serious loss of dessert quality or the development of breakdown. A temperature of 32° F. is recommended.

343. DAVIES, R., BOYES, W. W., AND DE VILLIERS, D. J. R. 664.85.24

Storage of Goldmine nectarines.

Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 53-5.

Trials with one consignment stored at 31°, 34°, 37°, 40°, 45° F. show that nectarines are very like peaches in their storage behaviour. Quality improves with increasing maturity at picking and decreasing storage temperature. If appreciable ripening after storage is necessary, the potential qualities can only be realized by ripening at 65° F.

344. RATTRAY, J. M. 664.84.615

Melon storage investigation, 1938.

Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 55-65.

Melons were stored at 45°, 50°, 60°, 65° and 70° F. Wastage decreased with increase in storage temperature, though under certain circumstances fungi may be more dangerous at 60-70° F. than between 45° and 50° F. Granted that the extent to which melons will colour depends on maturity at the beginning of storage, there is also a tendency for the warmer storage temperatures to hasten colouring. Effect of temperature on ripening was not clearly shown. The best flavour was found at the warmer storage temperatures of 60° and 65° F. There appeared to be no advantage in delayed storing. Fungicides were not effective in reducing waste, especially in melons stored at 45° F.

345. RATTRAY, J. M. 664.85.8

Grape wastage* investigations, 1938.

Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 65-74.

Gros Colmar. There was confirmation of previous findings that waste in store due both to *Penicillium* and *Botrytis* increased with maturity at time of picking and storing. *Hanepoot.* Stem desiccation and drop berry were more severe at 29° F. than at 31° and 34° F. but *Botrytis* waste was less. 31° F. was a better storage temperature than 34° F. Rapid precooling prior to storing at 34° F. had no effect, but rapid precooling to 29° F. resulted in severe desiccation of stems and increased drop berry. There were slight indications of the greater freshness of grapes packed immediately on picking than of those not so immediately packed prior to cold storage. The minimum delay between picking, packing and storage resulted in the freshest, most attractive product.

346. VAN DER PLANK, J. E., AND RATTRAY, J. M. 664.85.872

The use of alkyl chloramines and tertiary alkyl hypochlorites as volatile preservatives for grapes.

Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 74-6, bibl. 4.

Diethyl chloramine and tertiary butyl hypochlorite, impregnated into plugs as solutions in

* See also 116-119.

mineral oil or in non-volatile saturated esters (e.g. triacetin, ethylene glycol diacetate), were sufficiently volatile and sufficiently fungicidal to control *Botrytis* waste in stored table grapes. [Authors' summary.]

347. VAN DER PLANK, J. E. 664.85.872
A device for the regulated release of sulphur dioxide in packages of stored table grapes.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 76-8.

The system described is based on the hydrolysis of aluminium sulphite by the water vapour within the package to yield sulphurous acid and so in turn sulphur dioxide. Actually instead of the sulphite a mixture of dehydrated alum (or aluminium sulphate) with sodium pyrosulphite or sodium bisulphite or sodium sulphite is used. The container to hold the alum-bisulphite, made of tough paper, is simple and is described.

348. BEYERS, E. 664.85.872 : 632.19
Further investigations of factors affecting "drop" and desiccation of stalks of Waltham Cross in storage.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 79-87.

Further experiments confirm previous findings. "The important points to bear in mind are that picking under cool conditions and avoiding delay in precooling are effective in reducing the prevalence of drop and desiccation of stalks after storage and that a sufficient supply of soil moisture in the vineyard during ripening and at harvesting improves the carrying capacity of the grapes. The amber colour and good flavour of high quality Waltham Cross necessitates picking at a stage of maturity slightly more advanced than the minimum requirements for the sugar-acid ratio and this tends to reduce drop after storage, but undue delay in picking results in deterioration of keeping quality in other respects, which cannot be compensated for by the reduction of drop berries."

349. BEYERS, E. 664.85.872 : 632.19
Relationships between "drop" and seedlessness in Waltham Cross grapes.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 87-9, bibl. 2.

Observations on Waltham Cross grapes show that the correlation observed by Haylett* and by Barter† between dehiscence and seedlessness is merely a spurious and transitory one in so far as it is supposed to show that seedlessness causes dehiscence.

350. BEYERS, E. 664.872-1.564
A shallow pack for export grapes.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 90-2.

In order to save cubic area in cargo space investigations were made on a flatter pack. It was found that so far as the condition of the grapes is concerned Waltham Cross, Almeria and Red Emperor can be successfully marketed in a shallow pack holding 10 lb. grapes, preferably in $3\frac{3}{4}$ or 4 in. boxes with wood-wool packing. This type of pack was not so successful with Prune de Cazouls, Alphonse Lavalle or Barlinka.

351. ANISIMOV, N. I., AND DIAKONOV, A. P. 664.85.11 + 664.85.13 + 664.85.8
Long storage of apples, pears and grapes. [Russian.]
 Moscow, Gostorgizdat, 1939, pp. 56, 1.25 roubles.

* Unpublished paper read before roy. Soc. S. Afr., Capetown, Sept. 1935.

† Rep. Overseas Representative. *Bull. S. Afr. Decid. Fruit Exch.*, 35, 1936.

352. DREOSTI, G. M., BOYES, W. W., AND DE VILLIERS, D. J. R. 634.3-1.564
Strength of citrus boxes.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938,
 1939, pp. 260-71.

The various components of a citrus box are briefly examined in relation to their effect on the strength of the box. Preliminary tests have been made with packed boxes, and the first nails to draw during rough handling are shown to be those holding the slats to the centre piece. Strapping round the centre is much more important than at the ends of the box, and the latter strapping could be dispensed with, provided additional nailing is practised at the ends. Nailed strapping assists considerably in providing a rigid box; additional nailing also increases the rigidity. The holding force of nails is briefly considered. One of the types of box-testing machines made in the Laboratory is briefly discussed, and the value of rigid box-ends is demonstrated. [Authors' summary.]

353. VAN DER PLANK, J. E., RATTRAY, J. M., BOYES, W. W., and DE VILLIERS, D. J. R. 664.85.3.037
The effect of temperatures of storage between 35° F. and 55° F. on navel oranges.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938,
 1939, pp. 126-42, bibl. 2.

The effect of temperature again varied with the nature of the fruit stored. In some oranges, those from Cape Province, wastage was much the same at 50° F. as at 40° F., but in others from Lowveld wastage varied considerably, both immediately after storage and after removal and holding at 65° F. for 2 weeks. Fruit from the Transvaal was very resistant to blemishing, even when stored as low as 35° F. In consignments containing immature fruit the colour was markedly improved and the flavour and texture slightly improved by storage at 50°-55° F. instead of at lower temperatures.

354. TOMKINS, R. G. 664.85.31.035.1 : 632.4
The rotting of oranges by green mould.
Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 184-6, bibl. 1.

After spraying with a suspension of *Penicillium digitatum* spores storing Jaffas in an open tank under dry conditions (70% R.H.) reduced the incidence of rotting. Storage in a saturated atmosphere under restricted ventilation, allowing the accumulation of CO₂ up to 10%, did not increase wastage as compared with storage in a saturated atmosphere free from CO₂. Wastage in the early season (November) was greater than in the later season (March and May) fruit. Reduction of temperature of storage from 18°C. to 10° C. delayed the onset of rotting and decreased the rate of its progress. Reduction from 10° C. to 5° C. reduced the onset of rotting but not its subsequent rate. In view of this initial reduction, storage at 5° C. appears preferable.

355. RATTRAY, J. M. 664.85.3 : 632.4
Dipping experiments with oranges.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938,
 1939, pp. 170-6, bibl. 3.

A number of disinfectants were used as dips against green mould on oranges suitably wounded and heavily loaded with spores. After inoculation the fruit was held for 24 hours at 65° F. before being dipped. After dipping it was air-dried, wrapped and stored at 55° F. Disinfectants used were as follows:—*Wyandotte steri-chlor*. This contains 16% sodium paratoluene-sulphonchloramide. A 0.33% concentration was fairly effective after 10 minutes at 104°-108° F. and a 1.0% concentration was even more effective after 2 minutes at that temperature. *Shirlan WS*. This is the water-soluble sodium salt of salicylanilide. Cold solution appeared as effective as hot solution. *O-phenyl-phenol* and other phenolic derivatives known as "Dowicides". Dowicide A, i.e. the sodium salt of o-phenyl-phenol, proved very successful as a dip at concentrations of 0.02% to 0.08%.

356. VAN DER PLANK, J. E. 664.85.323.037 : 632.19
Cold injury of grapefruit.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938,
 1939, pp. 145-55, bibl. 2.

In confirmation of the observation of Tomkins and Dreyer, it was found that fruit was most susceptible to cold injury if picked from the outside of the tree. The effect of delayed storage in pitting of Marsh grapefruit was linked with the period in store. With storage at 40° F. for short periods (e.g. 3 to 4 weeks) delayed storage was generally beneficial and the length of the delay was not of very great importance. With intermediate periods of storage, a short delay (e.g. 1 or 2 days) at 80° F. was most beneficial, and long delays were dangerous. With long periods in store, delayed storage of any length was of little use in reducing injury. In fruit stored without delay injury mostly developed during the first few weeks at 40° or 45° and thereafter increased very slowly. Delayed storage reduced the amount of injury found after three or four weeks but accelerated subsequent development of injury. That is, it reduced primary but increased secondary susceptibility. In explanation of the latter, it is suggested that the weakening processes which result in secondary susceptibility in cold store are related in some way to the weakening processes which occur during extended delayed storage. [Author's summary.]

357. FURLONG, C. R., AND BARKER, J. 664.85.323.037
The effect of the temperature of storage on early, middle and late season Palestine grapefruit.
Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 169-71.

After 40 days storage at 65° F. all samples were wilted and useless for commercial purposes. At 45° F. slight brown pitting developed on some fruits of one brand of fruit. In the fruits of the other two brands a low temperature spotting occurred.

All samples stored at 34° F. developed low temperature injury which was characterized by the development of a superficial browning of the skin between the oil cells at many places over a large area. This was followed by collapse of the oil cells and tissue and the formation of many chocolate brown spots surrounded by a ring of superficial browning. Early season fruit was less resistant to this type of injury than mid-season and mid-season than late season fruit.

358. MILLER, E. V., AND SCHOMER, H. A. 664.85.34
Physiological studies of lemons in storage.
J. agric. Res., 1939, 59 : 601-7, bibl. 5.

The experiments described here were made on green Californian lemons shipped under ventilation in carlot shipments from Los Angeles to New York and thence by ordinary express to Washington, D.C., where they were stored at the Arlington Experiment Farm at 32°, 36°, 40°, 50° and 60° F. The authors summarize as follows:—

. . . The peel was analysed for sugar, glycosides, acids, and reductase activity before, during and after storage. The flesh was analysed for sugar and acetaldehyde.

Reducing sugar and total sugar in both peel and flesh diminished in quantity during storage of the fruit. These tissues contained only slight amounts of sucrose.

Both total acids and glycosides in the peel increased during storage.

Varying amounts of acetaldehyde were found in the flesh at the time of the mid-storage and final sampling dates.

No relation was found between any of the above-mentioned substances and the development of pitting and membranous stain in the fruit.

Reductase activity of the peel, as measured by the rate of reduction of potassium permanganate solutions, was consistently lower for the samples stored at 32°, 36° and 40° F. than for those stored at 50° and 60°. Inasmuch as the lower temperatures (32°, 36°, 40°) are most conducive to development of pitting of lemons in storage, it is suggested that oxidizing enzymes may play a role in the development of this disorder.

359. VAN DER PLANK, J. E., RATTRAY, J. M., CROUS, P. A., AND KRIEL, J. 664.85.34.037

The storage of lemons.

Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 156-69, bibl. 3.

Lemons from three centres were stored for 4 weeks at 40°, 45°, 50° and 55° F. There were indications that picking greener had a beneficial effect on wastage. Fruit picked moderately green coloured ripened considerably during storage at 50° or 55° and these processes did not appear to render the fruit more liable to waste. Red blotch (adustiosis) and membranosis were slightly increased by greener picking. Low temperature sometimes appeared to contribute to the development of membranosis. Fruit picked moderately green gained considerably in quality by storage at 50° F. as compared with unstored fruit or fruit stored at a lower temperature.

360. FIDLER, J. C., AND TOMKINS, R. G. 664.85.3 : 632.4

Dipping for the control of fungal rotting of citrus fruit.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 189-90, bibl. 12.

Preliminary experiments, which, however, need confirmation on a larger scale, suggest (1) that spreaders do not offer a way of increasing the effectiveness of borax in reducing green mould, (2) that borax solutions can be made more effective by the addition of sodium hydroxide, (3) that dipping oranges in 2% sodium hydroxide reduces green mould as effectively as dipping in 5% borax and leads to less skin injury.

361. HWANG, L., AND KLOTZ, L. J. 664.85.3 : 632.4

The toxic effect of certain chemical solutions of spores of *Penicillium italicum* and *P. digitatum*.

Hilgardia, 1938, 12 : 1 : 1-38, bibl. 43.

The aim of the study reported here was to find more definite and effective methods of controlling the blue and green moulds of citrus fruits by chemical solutions. Excluding the sodium hypochlorite solutions which killed all the spores of both fungi, the three most efficacious solutions, when used at 100° F. and below for 5 minutes were 6% sodium carbonate, 1.15% sodium-o-phenylphenate and 6% borax; at 110° F. and 120° F. the three most toxic were 0.4% chloramine-T, 6.0% sodium carbonate and 6% mixture 2 : 1 of borax : boric acid.

362. FARKAS, A. 664.85.3.038

Control of wastage of citrus fruit by impregnated wrappers on a commercial scale.

Hadar, 1939, 12 : 227-31, bibl. 6.

Citrus fruit wraps impregnated with diphenyl have proved most effective in preventing wastage of fruit in storage and transport in Palestine. Diphenyl taken internally has been proved by experiment harmless to man, monkey and rat. Palestine citrus fruit so wrapped arrives on the English market in a perfectly natural condition and free from alien smell or flavour. The annual loss from wastage in picked fruit, especially towards the end of the season, is severe. It is estimated that by the use of these wrappers LP 100,000 per annum could be saved on the Jewish crop of 7 million boxes. The use of the wrappers would enable the crop to be held back during a market glut for an additional week or the fruit intended for U.K. could be shipped early and held in England, so avoiding the increased customs duty of 1s. 6d. per box which occurs after 31 March.

363. VAN DER PLANK, J. E., AND RATTRAY, J. M. 664.85.3.038

The use of wraps impregnated with o-phenyl phenol against decay in oranges.

Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 142-5, bibl. 2.

It was confirmed that o-phenyl-phenol impregnated into wraps reduced *Penicillium* decay of oranges, but severe scalding of the rind occurred at all strengths used. The use of mineral oil

as a solvent failed to stop this injury. Analytical data are presented on the vaporization of o-phenyl-phenol from wraps during storage.

364. TOMKINS, R. G. 664.85.038 : 632.4

Treated wraps for the prevention of fungal rotting.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 186-9, bibl. 3.

Wraps treated with o-phenyl-phenol and either sodium hydroxide, urea, diphenylamine, benzamide, guanidine or piperazine cause damage to fruit. Wraps treated with o-phenyl-phenol and either benzidine or hexamine do not injure oranges and do retard rotting due to *P. digitatum*. The appropriate quantities of hexamine are discussed, the most suitable proportion being, apparently, a little more than 35 parts of hexamine to 170 parts of o-phenyl-phenol. Wraps impregnated with o-phenyl-phenol and hexamine cause some injury to apples and bananas. Tomatoes and grapes are not injured by them.

365. WARDLAW, C. W. 664.85

Cold storage and transport of tropical fruits.

J. roy. Soc. Arts, 1939, 88 : 22-33, reprinted from Proc. Brit. Assoc. Refrigeration (undated).

The problems and difficulties connected with the cold storage and transport of tropical fruits are described. The chief difficulties are to retard the ripening of the fruit and the onset of wastage without blemishing the fruit by chilling; in this connexion it is noted that every kind of fruit has a different degree of resistance to chilling. The importance of maintaining correct humidity relationships is shown. Relative humidity should not be so low as to allow of serious loss in weight or affect ripening or appearance during storage or so high as to promote the growth of fungal hyphae or localized condensation within the cargo stack. The need of more local cold fruit stores in the tropics is noted.

366. LEONARD, E. R. 664.85

Studies in tropical fruits. VI. A preliminary consideration of the solubility of gases in relation to respiration.

Ann. Bot., Lond., 1939, 3 : 825-43, bibl. 12.

The author deals in turn with:—the terminology used in discussing the solubility of gas in liquids; the solubility of air in water in relation to temperature; the solubility of different gas mixtures found in the internal atmospheres of fruit, i.e. N_2 , O_2 and CO_2 in water; the solubility of other gases such as ethylene; the influence of solutes on the solubility of gases. Tables and graphs are given and their application to respiration studies of the papaw is noted.

367. WARDLAW, C. W., LEONARD, E. R., AND BARNELL, H. R. 664.85.771

Studies in tropical fruits. VII. Notes on banana fruits in relation to studies in metabolism.

Ann. Bot., Lond., 1939, 3 : 845-60, bibl. 6.

A brief description is given of the development and morphology of the banana, which exhibits considerable differences from other fruits. Some of the causes of variability in the final size of the fruit bunch are discussed in relation to the subsequent behaviour during storage. For the Gros Michel banana data are given of weights of individual "fingers" and of the proportion of pulp to skin during development up to the final senescence and collapse of the individual plant. In relation to the choice of experimental material, corresponding data are given for individual fingers and "hands" of bunches at the stages of maturity adopted in commercial practice for harvesting with subsequent cold storage. [Authors' summary.]

368. BARNELL, H. R. 664.85.771
Studies in tropical fruits. VIII. Carbohydrate metabolism of the banana fruit during development.
Ann. Bot., Lond., 1940, 4: 39-71, bibl. 19.

An account of investigations at the Low Temperature Research Station, Trinidad, into the carbohydrate metabolism of the Gros Michel banana during its development on the plant. Other objects of the work were to define the biochemical status of standard export and heavier grades for relation with their storage behaviour, as also to ascertain the maximum size attained by fruits before ripening processes start while still on the plant. The data which are graphed and tabulated are discussed.

369. WARDLAW, C. W., LEONARD, E. R., AND BARNELL, H. R. 664.85.771
Metabolic and storage investigations on the banana.
Mem. Low Temp. Res. Stat., Trin., 11, 1939, pp. 61.

I. *Metabolic studies of the Gros Michel banana.* Some of the information now available as a result of the investigations in progress at the Imperial College of Tropical Agriculture, Trinidad, is generally discussed with the promise that a series of papers shortly to be published will give more detailed information. Among the findings of practical importance are the following:—The standard grade known as $\frac{3}{4}$ full, at which fruit is usually harvested for the English market, is a comparatively immature grade. If growth is allowed to continue up to the size limit for storage individual fingers increase in weight up to 50% and the actual edible matter, the pulp, up to 60%. The greatest development of starch and dry matter takes place during the two or three weeks following the age level at which the fruit would normally have been picked for export. Since only small differences have been observed in the carbohydrate composition between $\frac{3}{4}$ full, heavy $\frac{3}{4}$ full, and full fruit, harvesting maturity must be defined by size rather than by composition of the fruit. Respiration studies show that the part played by oxygen is of particular interest. The rate of water loss during ripening can be correlated with changes in ripening colour, softening, etc., and with the curve of respiration rate. The importance of a knowledge of the part played by relative humidity and cognate factors during storage and ripening is stressed. The need for expeditious handling and prompt cold storage after cutting is shown by biochemical studies which reveal definite ripening changes that otherwise occur within the first 24 hours. Ripening is characterized by increased metabolic activity involving increased utilization of O_2 , increased production of CO_2 , a rise in pulp temperature and rapid changes in the principal metabolites. These metabolic changes are slowed down by storage at 53° F. and changes in the CO_2 and O_2 concentrations in the tissues are produced which have considerable importance in relation to gas storage technique. Fruit which remains green during cold storage shows only minor biochemical changes in carbohydrate constituents during the period. Fruit kept in cold storage beyond the normal period for each grade shows biochemical changes indicative of ripening. Such prolonged cold storage treatment is productive of chilling symptoms giving an abnormal appearance and, on ripening, a russety dull skin and an astringent pulp. The starch, acid and glucoside contents are high and the sugar content low; in chilled fruit, also, the rate of hydrolysis is relatively low compared with standard grades of fruit which have been cold stored without chilling.

II. *Storage investigations* have been published *Trop. Agriculture, Trin.*, 1939, 16: 130-42, *H.A.*, 9: 1062.

III. *Banana transport.* A comparison of storage conditions in a modern ship and in earlier types has been published *Trop. Agriculture, Trin.*, 1939, 16: 200-2, *H.A.*, 9: 1477.

370. NELSON, R. C. 664.85.711: 547.313.2
Production and consumption of ethylene by ethylene-treated bananas.
Plant Physiol., 1939, 14: 817-22, bibl. 5.

In a previous paper (*Food Res.*, 1939, 4: 173-90) the author described the emission of ethylene by bananas into a closed chamber during ripening. In the present paper the effect of adding ethylene is described. His conclusions are as follows:—"Ethylene is consumed by the bananas

in the course of the ripening process, probably in connexion with the hydrolysis of starch. Ethylene treatment of fruits already producing ethylene is believed to accelerate ripening because of this fact."

371. MORRIS, T. N., AND BARKER, J. 664.85.75.037
The freezing of fruits.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 190-1, bibl. 2.

The most effective method of rapid freezing strawberries prior to storage consisted of immersing the fruits directly in a syrup containing 62.5% sucrose and 10% glycerine at -20°C . or in 62.5% sucrose at -10°C . Samples stored thereafter at -20°C . were better than those stored at -10°C . Owing to the difficulty encountered as the result of the high viscosity of syrups at low temperatures the possibility of preparing syrups or other refrigerants of lower viscosity is being investigated. An excellent product for dessert or flavouring has been obtained by slicing strawberries and either stirring in a quarter of their weight of dry powdered sugar and allowing it to dissolve or covering with strong syrup and storing at -20°C .

372. MORRIS, T. N., AND BARKER, J. 664.84.037
The freezing of vegetables.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 209-10.

Samples of peas and asparagus quickly frozen by direct immersion for 2 to 3 minutes in 22% NaCl brine at -20°C . were better after 4 months' storage at -20°C . than those frozen less rapidly, i.e. in tins immersed in brine at -20°C . Slow freezing gave very poor results. This immersion method seems at present only applicable to vegetables such as the above which do not absorb a large proportion of salt during freezing. Tests with spinach and cauliflower showed these to be unsuitable for direct brine immersion.

373. PLATENIUS, H. 664.84
Effect of temperature on the rate of deterioration of fresh vegetables.
J. agric. Res., 1939, 59: 41-58, bibl. 8.

The vegetables with the storage of which these experiments at Cornell were concerned were peas, spinach, radish, lettuce, celery, brussels sprouts, asparagus and sweet corn. They were stored in ordinary commercial containers, e.g. peas in 1 bushel baskets, etc., in cold storage rooms kept at 35°F ., relative humidity 94; 50° , R.H. 82; 65° , R.H. 74; and 80°F ., R.H. 68. Effects of the different treatments on each vegetable are plotted and discussed at some length and in some detail.

374. METLITSKY, L. V. 664.84
Certain important problems in the storage of vegetables. [Russian.]
Vegetable Growing, Moscow, 1939, No. 8, pp. 39-42.

As a result of the investigations in U.S.S.R. carried on for some time by the Scientific Research Institute for Vegetables (N.I.I.O.Kh.) some knowledge has been gained on the storage requirements of certain vegetables. *Roots* require a relative air humidity of 90-95% and a temperature of $0-2^{\circ}\text{C}$. Under such conditions carrots can be stored until as late as May. *Cabbage* requires a temperature of -2° to 1°C . and a relative air humidity of 90-95%. When storing at -2°C . top leaves must not be removed from the heads prior to storage. *Onions*. Mature bulbs and table onions should be stored at about 0°C . and atmospheric humidity of 80-85%, and seed onions at the temperature range from 18° to 25°C . with 65-75% humidity. *Melons*. At present the temperature of 0°C . is considered best. Further investigations into temperature and moisture requirements of melons are taking place. *Tomatoes*. Stored at the green stage of maturity they are best kept at $18-25^{\circ}$ with a relative humidity of 80-85%. A large proportion of fruits does not fully mature when lower temperatures are employed, irrespective of whether or not ripening of the fruits is stimulated by certain treatments. Holding immature fruits for several

days at low temperatures, i.e. 1-3° C., is sufficient to prevent most of them from ripening afterwards. Hence only fully mature fruits should be stored at low temperatures. Tomato fruits keep well when stored in peat dust. A large section of the article deals with aeration problems.

375. SMITH, W. H. 664.84.356.035.1

The gas storage of broccoli.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 202-8.

Data are presented on the incidence of mould on broccoli stored for various periods at 32° F. and 38° F. in the following atmospheres:—Air; O₂ 21%, CO₂ nil; O₂ 10%, CO₂ nil; O₂ 10%, CO₂ 10%; O₂ 5%, CO₂ 10%; O₂ 2.5%, CO₂ 10%.

376. BARKER, J. 664.84.21

The storage of new potatoes.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 201-2, bibl. 2.

Tests on the storing of new potatoes in peat moss alone at 50°, 45° and 41° F. are reported. Samples of immature King Edwards stored at 50° and 45° F. developed brown areas on the skin, which, however, disappeared on scraping the skins before cooking. Even after 5 months at these temperatures the skin could still be removed by scraping and the tubers retained the appearance of new potatoes on cooking. The flavour was also fairly well retained. A temperature of 41° F. proved too low, the flesh becoming slightly yellow, and when cooked soggy in texture and sweet. Late lifted samples did not develop the brown spots nor did they lose the appearance of new potatoes after storage but their consistency and flavour were those of old potatoes. [The author notes that for marketing it is the appearance which counts.—ED.]

377. ZILVA, S. S., AND BARKER, J. 633.491 : 577.16

The ascorbic acid content of potatoes.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 199-201, bibl. 4.

Investigations of vitamin C content were made with King Edward potatoes, lifted at various stages of maturity and stored at 10° C. At the first lifting on 20 July, the potatoes showed a content of 38.9 mg. of ascorbic acid per 100 g. tissue and this increased to 45.3 mg. on 7 September, a concentration of the same order as that of such rich sources as citrus fruits. Later liftings showed a decrease. The content fell rapidly in store, especially in the early liftings. The vitamin C content of potatoes obviously varies greatly with variety. Thus, indophenol tests give much lower values for Majestic than for King Edward.

378. BARKER, J. 664.84.21

The effect of temperature history on the sensitivity of the sugar/starch balancing system in potatoes.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 193-5, bibl. 2.

ALLEN, R. J. L.

664.84.21

The role of phosphorus compounds in the carbohydrate metabolism of the potato.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 196-8, bibl. 2.

ISHERWOOD, F. A.

664.84.21

Reducing substances in the potato.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 198-9, bibl. 7.

379. METLITSKY, L. V. 664.84.13

A method for commercial storage of carrots. [Russian.]

Vegetable growing, Moscow, 1939, No. 9, pp. 38-40.

Recent trials in Central Russia of storing carrots in air-tight or nearly air-tight wooden chests, the principle being gas storage in the atmosphere created by respiration, gave good results.

The carrots stored by this method contained larger amounts of sugar and were less susceptible to rots, particularly to *Sclerotinia libertiana*. Hard wood such as oak was found to be unsuitable material for making the chests intended for long storage of carrots since it encourages fermentation.

380. ZOZULYA, V. S. 635.64 : 581.192
The chemical composition of tomato fruits reaching maturity on the plant and that of fruits maturing in store. [Russian, German summary 18 lines.]
Proc. agric. Inst. Krasnodar, 1935, No. 3, pp. 147-54.

In South Russian analyses of tomato fruits the following conclusions were reached :—After long storage immature fruits developed a red colour but contained smaller amounts of sugar and had a less satisfactory flavour than fruits that had matured on the plant. This was particularly noticeable in fruits of small-fruited varieties. Store-matured fruits of tender-fruited varieties had a less satisfactory flavour than others owing to increased acidity. With a few exceptions juice concentration was greater in fruits that had ripened on the plant than in store-matured fruits.

381. DREOSTI, G. M., AND WISSING, P. 631.546.6 : 634.1/7
Penetrometers for fruit.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 271-5.

A preliminary investigation of penetrometers, especially as regards the plungers, was made using cucumbers and marrows for the tests. It was found that even new instruments were liable to very large errors due to the speed of working. The readings are not proportional to the cross-sectional area of the plunger and the force is not uniformly distributed over the face of the plunger. The exact shape of the plunger face does not appreciably affect the readings. The errors noted after so short a time indicate the necessity for improvement.

382. DAVIES, R., AND COOPER, C. E. B. 664.85.037
Capetown precooling store.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 241-60.

A full account of equipment at this modern, recently erected store.

383. HARDY, J. K., AND HALES, K. C. 664.85 : 631.564
The resistance of stacked boxes of fruit to air flow.
Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 251-8, bibl. 3.
 HALES, K. C. 664.85
Tests of a reversible fan.
Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 258-63, bibl. 5.
 HARDY, J. K. 664.84/85
The automatic control of temperature at the Covent Garden laboratory.
Rep. Fd Invest. Bd, Lond., for 1938, 1939, pp. 264-5.
 DREOSTI, G. M., AND WISSING, P. 664.85 : 536.582.2
A precision multiple point thermometer outfit.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 176-202, bibl. 12.
 DREOSTI, G. M. 664.85 : 536.582.2
Heating effect and lag of small resistance thermometers.
Rep. Low Temp. Res. Lab., Capetown, for year June 1937 to June 1938, 1939, pp. 203-32, bibl. 6.

PROCESSING AND PLANT PRODUCTS.

384. ANON. 631.56
Recent research on Empire products.
Bull. imp. Inst., 1939, **37** : 368-87.

Brief notes are given of the recent work of the Government technical departments overseas. Most of the information is available in the annual reports of the departments of agriculture concerned.

385. TORIÑO, H. G., AND SALA, R. T. 663.257.8
 Envejecimiento de vinos bajo la influencia de la acción solar. (**Maturing wine by the use of the sun's rays.**)

Reprinted from *Rev. Fac. Agron. Montevideo*, No. 18, June 1939, pp. 28.

Previous work in the Crimea and elsewhere on the use of the sun to mature wine is noted by the present authors, who primarily set out to determine the influence on wine so matured of the following factors:—the sun—in wines worked with or without SO_2 and with NaCl ; alcohol and acidity; soil; colour of receptacle; disposition of receptacles, whether close together or separated; volume of receptacle; orientation of receptacle. They come to the following conclusions:—wines for such treatment should have a high alcohol content (min. of 18°), and adequate volatile acidity (5.5 expressed as H_2SO_4). They should contain sufficient tannin to avoid any unfavourable effect on bouquet due to subsequent loss of it. The receptacles should be of clear transparent glass, of small size—i.e. a demijohn is suitable—and should not be completely filled. The length of exposure to the sun should be limited so as to induce maturity without impairing the distinct character of the wine or its bouquet. With the wine treated in the authors' experiments and under their conditions 5 months exposure can be considered a satisfactory maximum.

386. OSTERWALDER, A., AND JENNY, J. 663.813
 Die wissenschaftlichen Grundlagen der Süssmosteinlagerung unter Kohlen-säuredruck. (**Scientific basis of fruit juice storage under CO_2 pressure.**)
 [French and German summaries.]
 Reprinted from *Landw. Jb. Schweiz*, 1939, pp. 373-426.

The present paper consists of a physical and of a biological section. The former deals with the laws and principles on which the preparation of unfermented juices under action of CO_2 pressure is based. In the biological section the following points are considered:—(A) Closed fermentation without initial pressure (development of pressure as fermentation takes place). (B) The effect upon fermentation yeasts of CO_2 at high pressure. (C) The effect upon fermentation yeasts of higher air and oxygen pressures. The results of thirty separate experiments, which are described at some length, are presented in tabular form.

387. ANON. 663.813 : 634.11
Apple juice successfully canned at Ohio plant.
Fruit Prod. J., 1939, **19** : 105-6.

A process of canning apple juice without chemical preservatives is described. The method of sterilizing is by flash pasteurization.

388. ANON. 663.81
Apple juice and fruit syrups.
Food Manuf., 1939, **14** : 151-5, 166.
 A brief summary of papers abstracted in *H.A.*, 9 : 1078.

389. ANON. 663.813 : 634.3

The preparation of citrus fruit juices.

Bull. imp. Inst., 1939, **37** : 359-64, bibl. 8.

The methods described are those in which the expressed juice is preserved by the addition of a chemical, usually sulphur dioxide, and is not cleared, and the U.S.A. methods in which the juice is cleared and is preserved by flash pasteurization. Cleared juice is inferior to that in which the cells are allowed to remain. An account of clarification by the gelatin-tannin process is quoted from circular 344 of the California Agricultural Experiment Station, 1937. The uninformed section of the public is satisfied with a fruit juice cordial compounded of some juice, added syrup, flavouring, colouring and preservative materials, but the more fastidious insist on a juice closely approximating to the fresh natural product, to obtain which requires great care in manufacture and an increased cost.

390. ZILVA, S. S., AND MORRIS, T. N. 664.85.11.036.5 : 577.16

Effect of prolonged storage on vitamin C in canned apples.

Rep. Fd Invest. Bd, Lond., for 1938, 1939, p. 222, bibl. 1.

Apples canned in January 1935 and tested biologically in January 1938 were found then to have lost 50% of their antiscorbutic potency. The possibility of adding synthetic vitamin C to similar products when canning is noted.

391. ELSWORTH, F. C. 664.85.25.036.5

Australian peach canning.

Food Manuf., 1939, **14** : 242-3, 241.

The processes involved in the canning of peaches in the Murrumbidgee Irrigation Area, Australia, are described.

392. CROCE, F. M. 634.13-1.563.2

Desecación de la pera Williams. (Drying the Williams pear.)

Rev. B.A.P., 1939, **22** : 255 : 15-27.

The pears should be harvested when they have reached full size but are still green since they are of better quality if ripened off the trees. Nevertheless they are left a little longer than pears picked for eating fresh. The pears are mechanically graded into five sizes and into degrees of ripeness by hand, blemished fruit having been removed. They are then placed on covered trays to ripen, a process which may take from 5 to 10 days. During this period the losses may be from 3% to 25%. Much labour is often expended on picking out the pears as they ripen ; this can be avoided by ripening in acetylene gas, the use of which accelerates maturity and produces a uniform degree of ripeness. The conditions are, assuming a temperature of 21°-26° C., a dosage of 2/10 cubic foot at atmospheric pressure for each 1,000 cubic feet of storage space, administered twice a day. During the intervals the chamber must be thoroughly ventilated unless this happens to be a tent. After ripening the pears are halved longitudinally and if a high class product is desired the core is scooped out. The tendency of the drying sections to turn inwards at the edges is obviated by the removal of a thin strip of peel along the edge when coring. The pears are sometimes peeled by means of a knife or by immersion in a 10% sodium hydroxide solution for 20 seconds, if the fruit is full ripe, or 30 to 40 seconds if hard ripe. Green pears do not peel well. Immediately after peeling the sections are plunged in a 3%-5% brine solution or else merely sprinkled with salt water to prevent browning. The pears are now placed cut side down on trays and fumigated with sulphur for from 24 to 72 hours. They are then dried on trays which are superimposed with an air space of 2½ cm. between, the top tray being empty and used as a cover to guard against excessive desiccation. Traying takes 48 hours in the sun and about 6 weeks in the shade. A pear is sufficiently dried when it has become flat, flexible with slightly curved and rather dark edges, while the rest of its surface is clear and of the consistency of rubber. If cut across and squeezed between the fingers it should not exude moisture. When dry the pears are placed in a large receptacle clear of the ground. This is revolved once or twice daily for 10-15 days to ensure even distribution of moisture. The remainder of the

paper deals with artificial drying and describes methods already well established. There are notes on packing according to Argentine regulations, on the chemical composition of dried pears, and on cooking.

393. EOFF, J. R., JR., AND McVEIGH, W. J. 634.715 : 581.192

Blackberries do not contain tartaric acid.

Fruit Prod. J., 1939, 19 : 104, 111, bibl. 3.

From a method of analysis (Kling's) which is described, the question, on which there has been some recent controversy in U.S.A., as to whether blackberries contain tartaric acid was decided in the negative for canned and fresh, wild and cultivated blackberries.

394. ARNSDORFF, A., HUNTER, R. E., TOLKOWSKY, S. 634.3-1.563

The possibilities of a large-scale citrus by-products industry in Palestine.

Hadar, 1940, 13 : 9-12.

A report prepared on behalf of the Citrus Fruit Committee of the General Agricultural Council of the Government of Palestine on possible methods of utilizing the culls of the citrus crop, i.e. those fruits of inferior quality or unpopular size that cannot be exported. The suggestions are to experiment in the commercial manufacture of alcohol and dried cattle fodder from oranges and to nurse the existing by-product factories by the prohibition of importation of all jams, marmalades, fruit pulps and juices or any synthetic substitutes for natural citrus juice, and by the granting of a drawback on sugar used in the manufacture of citrus by-products. It is pointed out that if the local growers could get a price for unexportable fruit that would cover the cost of picking and hauling to the factory there would be a very great reduction of infection of packing sheds and of the fruit in the groves from the large quantities of waste fruit normally left lying about. It is thought that with an outlet for the inferior fruit the standard of that exported would automatically rise.

395. BRAVERMAN, J. B. S. 634.31 : 663.8

How to convert oranges into alcohol.

Hadar, 1939, 12 : 261-3.

A scheme is presented for using immediately in Palestine 1 million cases of oranges annually for the manufacture of alcohol and cattle fodder, the cost of new machinery being £P. 19,000, exclusive of building or working capital. The main provision of the scheme is the prohibition of the import of any raw material, especially molasses, for alcohol manufacture either permanently or until the capital invested has been entirely amortized. The price of alcohol would be fixed in accordance with the price of fuel. The object is to increase the quality and therefore the price obtained of the oranges exported from Palestine by providing an outlet for the inferior fruit which will keep it off the market. The scheme appears to a certain extent to cut across other local interests.

396. WALKER, A. 634.6-1.56

Utilisation du palmier *Elaeis*. (The uses of the oil palm.)

Rev. Bot. appl., 1939, 19 : 689-93.

Every part of the oil palm *Elaeis guineensis* is used by the natives of the Gulf of Guinea. The Abbé Walker describes a few of them. *Seed*. The orange-yellow oil from the seed mesocarp is used for many purposes, especially in cooking. For European cookery it has to be bleached. The kernel is eaten fresh ; the oil from the dried kernel is used by native women as an unguent. The dried fibres of the nut after oil extraction are used for tinder for fire lighting. The crushed seed cake is a cattle and poultry food. The hard shell of the nuts was formerly used to make rings. *Inflorescence*. A substitute for salt was formerly obtained by burning the male flowers, filtering the ashes and evaporating the liquid. The spadix, teased out at one end, makes a useful brush for whitewashing or claying buildings. The fibres of the spathe are used for sewing together broken calabashes, the join being first filled with a piece of fibre laid between the edges. *Foliage*. The leaves are used for provisional roofing, baskets and for many kindred purposes.

The veins are made into little brushes or fly whisks. The epidermis from the upper side of the young leaves is used for personal decoration in the case of a particular dance. The *petioles* are used in wicker work in making small traps for rats, crayfish, etc.; in case of need they can be made into paddles for light boats and into fishing rods and they also are used to make part or the whole of the climbing belt used by men ascending the tree. One tribe use the sap of the young petiole to cicatrize wounds. They obtain this by warming the middle of the section and then twisting it. The *felt* from the base of the leaves and on the spathe is dried for tinder and for caulking canoes. The *terminal shoot* or cabbage is eaten as a vegetable and boiled with pimento is used as a cure for bronchitis. The pure sap obtained by tapping the base of this shoot, apart from its use in making palm wine, is also used for leavening bread. The *roots* either chewed or macerated with roots from certain other plants are taken as an aphrodisiac. The trunk of the palm when green is made up into various objects particularly walking sticks. When dry it is much subject to borer attack. The detritus from decayed trunks spread on the soil is used for humus in the cultivation of vanilla.

397. JACK, H. W. 658.8
Small estate copra drier.
Agric. J. Fiji, 1939, 10 : 109-10, 1s.

A description and plan are given of an inexpensive platform copra drier suitable for small estates.

398. FROGGATT, J. L., AND MOODY, F. O. 658.8 : 632.78
Copra infestation by *Ephestia cautella* Wlk.
New Guinea agric. Gaz., 1939, 5 : 2 : 2-5, bibl. 2.

The biology and control of the moth, *Ephestia cautella* Wlk., in New Guinea are described. Control measures are based on cleanliness of storage sheds and ships' holds. Fumigation is too costly with copra at the present price.

399. COOKE, F. C. 658.8
Copra deterioration during storage and shipment.
Malay. agric. J., 1939, 27 : 424-35.

The investigations reported here reveal the unsatisfactory and unstable condition of half-cured copra, nevertheless half the world's copra is produced in this condition, one reason being that it offers opportunities for profit-making to the small man which are not realizable with a more reliable copra. Copra is subject to loss and deterioration during storage and transport, unless properly prepared and promptly warehoused. Such deterioration proceeds most rapidly at air temperatures and is reduced or checked at higher temperatures and temporarily by a film of smoke on the surface of the product. Loss and deterioration are very considerable in the case of "raw" half-dried copra if there is delay before it is suitably bulk-stored. When there is serious deterioration, the individual pieces of copra readily break down to yield "smalls" and "dust".

400. CHILD, R. 634.61-1.57
The destructive distillation of coconut shells.
Trop. Agriculturist, 1939, 93 : 195-204, bibl. 14.

The yields and composition of the products from the dry distillation of coconut shells are reviewed with the object of providing data on which may be based consideration of their possible economic development. 40,000 tons of coconut shells are burned annually in Ceylon to produce 13,600 tons of charcoal. There is no attempt to recover the by-products which would amount to 16,000 tons of pyroigneous acid, equivalent to 2,000 tons acetic acid and 2,400 tons of tar. The local rubber industry's requirements of acetic and formic acids do not exceed 500 tons annually. While the finished chemical products such as glacial acetic acid (99%), etc., cannot be attempted in

Ceylon the production of a purified pyroligneous acid for rubber coagulation and a grey acetate for export are believed to be technically possible. Further experimental work is needed in regard to the profitable employment of the tar.

401. CEYLON, DEPARTMENT OF AGRICULTURE.
Coconut oil.

634.61-1.57

Trop. Agriculturist, 1939, **93** : 76-80.

Instructions are given for the preparation of coconut oil free from a type of rancidity known as ketone rancidity, produced by the action of moulds, particularly when the oil is not free from moisture. Briefly, the copra must be well dried to 6% moisture, and be free from moulds, clean equipment must be used throughout, the cake residues, etc., must be separated from the crude oil as soon as possible and the settling tanks in which this is done frequently cleaned. The oil must be moisture free (British Standard Specification $<0.25\%$). Refined oil which has been subsequently washed must be filtered and/or heated to $110-120^{\circ}\text{C}$. This treatment, besides removing moisture, will effect sterilization. Storage must exclude light and air. Methods of doing this are suggested.

402. KAUFMANN, H. P., AND FIEDLER, H. 634.8 : 633.85
Beiträge zur Erschliessung neuer deutscher Fettquellen VII : Zur Gewinnung des Traubenkernöls.* (**New sources for oil production in Germany. VII. Oil from grape pips.**)

Forschungsdienst, 1939, **8** : 346-65.

Experiments conducted by the Forschungsdienst led to the following conclusions:—1. Pips from grape marc stored in a manner permitting exclusion of atmospheric oxygen contained more oil. 2. This was not due to the action of oil developing organisms nor to oil extraction from the marc nor to the change to oil of carbohydrates or sugars. 3. The increase in oil content is explained mainly by the physical processes within the pips. The presence of active anaerobic bacteria in the grape marc, which bring about the chemical reactions, causes a considerable rise in temperature for long periods. The temperature, which reaches, but does not exceed, 80° , brings about a disintegration of cell tissues within the pips. Owing to this the extraction of oil from the cells becomes more efficient, though the oil is actually there in any case. 4. Grape marc containing alcohol gives in similar experiments different results. This is ascribed to the destruction of certain substances during the process and the heat involved. 5. Results obtained in additional experiments confirm the theory that the oil is present in the pips at the beginning, that most of it can be removed from the pips by continuous extraction, and that it can be removed at once by short exposure to higher temperature. 6. There is some evidence that the residual oil extracted from the pips is true grape pip oil. 7. The disintegration process within the pips and the degree of hydrolysis of the triglycerides are determined by the temperature and by the length of exposure. Increased temperature and longer exposure bring about a more complete disintegration of the cell tissue, but they also increase the free fatty acids content in the oil, which impairs its quality. 8. A moderate degree of decomposition turns into a more rapid decay, if the grape marc is stored under unfavourable conditions, i.e. access of air, high humidity and excessive warmth. This results in a fall of the oil content in the pips. 9. It has been shown that grape pip oil is not a fat which contains natural oxidized fatty acids. The high hydroxyl numbers occasionally observed in grape pip oils must be attributed to the presence of oxidized fatty acids, which are due to unfavourable storage conditions.

403. JAMAICA AGRICULTURAL SOCIETY. 633.73-1.56
Memorandum on improvement of coffee quality.
J. Jamaica agric. Soc., 1939, **43** : 139-45.

The method of curing coffee in the cherry without washing is shown to produce an earthy taste from excessive fermentation which is absent from washed coffee. It is stated that this practice

* From the Institute for Pharmacy and Chemical Technology of the Münster University.

of curing coffee in the husk is directly responsible for recent complaints and consequent lowering of demand for certain Jamaica coffees.

404. DEVONSHIRE, C. R.

633.73-1.56

Liquoring terms.

Mon. Bull. Coffee Bd Kenya, 1939, 5: 65, 88.

The meaning of the terms used by the Liquoring Department to describe various foreign flavours in Kenya coffee is explained. *Fruity*: flavour suggestive of fermenting fruit pulp, naturally peculiar to early crop from high altitudes, but also caused by overripe coffee. Often an early stage of *Sour*: flavour suggesting rotting coffee pulp caused by several forms of improper fermentation. *Greenish, green*: flavour suggests hay; from insufficient drying. *Grassy*: pronounced green flavour; from improper drying or damp storage. *Strong*: describes unbalanced strength; inherent in soil or climatic conditions or from amber beans or green parchment. *Harsh*: usually from drought-stricken or over-bearing trees. *Common*: poor liquor, lacking acidity, cause sometimes as for *harsh*. *Woody*: peculiar to old coffee. *Earthy, musty*: from faulty drying or water damage after drying. *Unclean*: almost foul. *Foul*: objectionable liquor, similar to very rotten coffee pulp; invariably from bad factory preparation. One badly discoloured pulper-nipped bean will give a foul cup to an otherwise good liquor. *Taint*: usually employed with a descriptive adjective, e.g. fishy, sourish, etc. Such taints may be insufficient to affect market value but are noted in the report as a useful warning for future outturns. In a second article (p. 88) the terms used in the reports on raw or roast coffee are defined and the causes of the blemishes explained.

405. O'BRIEN, T. E. H.

633.912

The quality of plantation rubber.

Quart. Circ. Rubb. Res. Scheme Ceylon, 1939, 16: 24-31.

The sources of variability in raw rubber are (1) source of latex, (2) tapping method, (3) changes in latex between tree and factory, (4) factory procedure. (1) and (2) are beyond the planter's control; it is unwise at present in the case of (2) to condemn any system on the ground that it increases variability. (3) The use of dirty vessels and delay in handling latex lead to fermentation affecting the vulcanizing properties of the rubber. (4) The bulking of latex in the factory is an important step towards promoting uniformity and the same may be said of almost any improvement in factory equipment. Examples are given. The introduction of grit into the latex is unavoidable on the estate. Foreign bodies can be eliminated at the factory by means of a settling tank in which the latex is diluted and allowed to stand for an hour before being drawn off through an outlet slightly above the bottom of the tank and passed through a fine sieve into the coagulating tank. Types of sieves are discussed. Sources of dirt in dry rubber have been found in debris from the ceilings, rust scales, termite droppings and so on. Contamination also occurs in transport to the shippers. Canvas bags seem to be suitable protective containers and can be used many times since the final baling for shipment is now done by the shippers. The danger of rubber substitutes superseding plantation rubber will be reduced only if the quality of rubber is maintained to meet the wishes of consumers.

406. RUBBER RESEARCH INSTITUTE OF MALAYA.

678.11: 634.61-1.57

Coconut water as a coagulant for latex.

Circ. Rubb. Res. Inst. Malaya 9, 1939, pp. 3.

Strained and fermented coconut water can be used to coagulate latex; 15 fluid ounces ($\frac{3}{4}$ pint) of coconut water are required for every gallon of diluted latex.

407. RUBBER RESEARCH INSTITUTE OF MALAYA.

678.11

The use of serum for coagulation of latex.

Circ. Rubb. Res. Inst. Malaya 8, 1939, pp. 2.

NOTES ON BOOKS AND REPORTS.

408. HENDERSON, I. F., HENDERSON, W. D., AND KENNETH, J. H. 41.3 : 5
A dictionary of scientific terms.

Oliver & Boyd, Edinburgh and London, (3rd edit.), 1939, pp. 383, 16s.

For those wanting a general dictionary covering the more usual terms used in botany, zoology, physiology, anatomy, etc., at a very moderate price, this book can be strongly recommended. In it are given for all words the pronunciation—in the reviewer's opinion a dangerous and irritating rather than a helpful thing to do—the derivation of the word—which is very helpful—and a definition. Such dictionaries can never be complete and all that is possible to the librarian is to collect them one after one and discard some of the more ancient. The present work will certainly hold its own for a few years.

409. KAINS, M. G., AND MCQUESTEN, L. M. 631.53
Propagation of plants.

Orange Judd, New York, 1938, pp. 555, 21s.

With its 600 illustrations this comprehensive guide for the grower and the student will be in great demand among those who appreciate concise information upon the practical problems of seed germination and testing, vegetative propagation by cuttings and layers, and the use of rootstocks and the commoner methods of grafting. The need for care in handling material both in the nursery and at setting out in the plantation, points often neglected, is explained in detail aided by some excellent pictures. The needs of the student and teacher are kept in mind throughout and fifty searching "practicums"* cover the subject. In a work of this scope certain exclusions are inevitable, yet even so the following omissions are surprising. Framing, now in general use, is not included. Again the vegetative propagation of rootstocks by the methods of layering here described appears cumbersome compared with the continuous-row layering common in European and some Canadian and South African nurseries. The importance of etiolation, without which many plants fail to root when layered, is not sufficiently stressed. And surely Hagemann's work, in Germany, on "leaf-bud" cuttings, tested by Tukey in America, should at least have been mentioned? Yet despite these minor blemishes the book deserves a warm welcome since it adequately replaces the earlier general nursery manuals. R.J.G.

410. INTERNATIONAL INSTITUTE OF AGRICULTURE. 632.97 : 351.823.1
La législation du commerce des plantes dans les différents pays. (Plant import and export legislation throughout the world.)

Institut international d'Agriculture, Rome, 1938, 2nd edit. pp. 363, 35 liras.

Regulations concerning the import and export of plants and other horticultural produce have been made by practically every country. In this publication these regulations, as they affect commerce, are briefly summarized and provide information which should save much correspondence on the part of all concerned.

411. INTERNATIONAL INSTITUTE OF AGRICULTURE. 633.85
The tung oil trees (Aleurites) and the tung oil industry throughout the world.

International Institute of Agriculture, Rome, 1938, pp. 237, bibl. 139, 20 liras.

The publication summarizes the present state of progress in the tung oil industry. There are four sections:—(1) Cultivation. (2) Present state of *Aleurites* in the different producing countries. (3) Technological study of the Chinese wood oils. (4) Trade in Chinese wood oils.

* Sets of questions based on information given in the text.—ED.

Much of the information was obtained through a questionnaire sent to the competent authorities in all countries situated in a latitude and possessing *a priori* conditions suitable for the crop. There is a good deal of interesting cultural information scattered through the pages.

412. INTERNATIONAL INSTITUTE OF AGRICULTURE. 31 : 634 + 635

Vegetable and fruit statistics.

International Institute of Agriculture, Rome, 1938, pp. 98, 20 liras.

The methods of compiling and presenting the vegetable and fruit statistics in all the countries which issue them are examined. In conclusion suggestions are made for improvement in the methods of crop estimation and reporting which, with due regard to conditions peculiar to each country, should be made universal.

413. CONDIT, I. J. 634.653 : 016

A bibliography on the avocado.

Citrus Experiment Station, Riverside, Calif., 1939, pp. 293. Mimeograph.

The author has endeavoured to collect, in so far as time and available library facilities have permitted, a complete bibliography of the avocado. In some instances references are included which only deal with the subject very briefly, but, as the author pertinently asks, who is to judge of the importance or otherwise of a reference? Naturally, in view of the recent great developments in the cultivation of the avocado the majority of the references are of the twentieth century but the historical side is not forgotten, the earliest in this section being dated 1526. The arrangement of the bibliography under sections makes for easy reference and increases the interest. The author is to be congratulated on his painstaking work. The fact that the work is mimeographed, though with no loss of legibility, seems to indicate that the supply of copies will be limited, which is a pity.

414. CANADA. 63(072)

The Dominion experimental farms.

Published by authority of the Hon. James G. Gardiner, Minister of Agriculture, Ottawa, 1939, pp. 47.

A short outline of the scope and work of the Dominion Experimental Farms. Notes on horticultural work carried on at the different research stations deal briefly with fruit breeding, rootstocks and tree building, vegetables, ornamentals, cold storage, fruit and vegetable products.

415. LENIN ACADEMY OF AGRICULTURAL SCIENCES, LENINGRAD. 632.651.3

Nematodes of agricultural crops. [Russian, English summaries.]

Selkhozgiz, Leningrad, 1939, pp. 247, bibls. for each section, roubles 9.15.

This account of nematodes in U.S.S.R. does not include work later than 1937. It is a symposium by 14 authors on the distribution of and damage caused by nematodes. Control measures are noted and nematode plant damage discussed. Those of horticultural interest, whose incidence is dealt with here, are *Heterodera marioni* on various plants including essential oil plants, the rootgall nematode, the sugar beet nematode (*Heterodera schachtii*), *Anguillulina dipsaci* on potatoes and other plants, various nematodes on tomatoes, and *Tylenchus* spp. on tau-saghyz seedlings.

416. NIKITA STATE BOTANICAL GARDENS, YALTA. 634/5

A survey of its activities for the period 1812-1937. [Russian.]

Lenin Academy of Agricultural Sciences, Moscow, 1939, pp. 192.

A symposium by Verbenko, Kolesnikov, Ryabov, Nesterenko and Nilov. The more important work with ornamentals, fruits and industrial plants at the Nikita State Botanical Gardens is noted, with special reference to recent achievements. The last paper deals with plant chemistry.

417. SHABLOVSKY, B. I. 634.1/7
The best Ukrainian varieties of fruit. [Ukrainian.]
 Ukrainian State Publishers of agricultural literature, No. 28 of 1937, Kiev,
 pp. 167, bibl. 108;
 and
 UKRAINIAN INSTITUTE OF FRUIT PRODUCTION. 634.1/7
Tree fruits and small fruits growing in Ukraine with lists of varieties. [Ukrainian.]
 Ukrainian State Publishers of agricultural literature, No. 27 of 1938, Kiev,
 pp. 334, bibl. in text.

In the first of these works (No. 28) the author discusses the suitability for cultivation under Ukrainian conditions of a large number of early and late varieties of apple, pear, plum, cherry, apricot and peach. In the second (No. 27) the information given in the first is extended to include small fruits. The recommendations also appear to be of a more definitely practical nature, being based on a study of the climatic and soil conditions of different parts of Ukraine.

418. MOSCOW AGRICULTURAL EXHIBITION COMMITTEE. 63
A guide to the Agricultural Exhibition in U.S.S.R.
 Selkholzgiz, Moscow, 1939, pp. 192, 2.00 roubles.

419. IMPERIAL ECONOMIC COMMITTEE, LONDON. 664.85 +664.85.047
Supplies of canned and dried fruit 1938.

H.M. Stationery Office, Kingsway, London, W.C.2, 1939, pp. 85, 2s. 6d.

This is the eighth volume in the series of annual reviews of supplies of canned fruit and vegetables and dried fruit in the United Kingdom. It follows the same lines as previous reviews. The figures for 1938 are provisional.

420. MINISTRY OF AGRICULTURE, LONDON. 635.1/7
Food from the garden.
Growmore Bull. 1, 1939, pp. 19, 3d.
 MINISTRY OF AGRICULTURE, LONDON. 635.1/7
Vegetable production in private gardens and allotments.
Growmore Leaflet. 1, 1939, pp. 6.

The first of these, costing 3d., is the edition *de luxe* of the second, which is distributed free. In it is contained all that the ordinary householder with a patch of ground 30 × 10 yds. should know in order to provide himself with abundant vegetables. The information includes notes on soil, reasons for cultural operations, hints on manuring and fertilizers, method of breaking up grassland, the compost heap. In addition a useful cropping plan is included and varieties are suggested, with proper amounts of seed. There is a rosy chart in which will be seen the wide choice of vegetables which can be expected every month from the garden or store—storing is strongly recommended. Useful notes are included on routine control measures for pests and diseases with a list of more detailed publications on the particular curse in question. We believe that the 3d. edition should prove extremely useful to the fairly hard-bitten country man or woman.

421. MINISTRY OF AGRICULTURE, LONDON. 635.9
Edible and poisonous fungi.
Bull. Minist. Agric., Lond., 23, 1939, pp. 25, 3s. 6d.

A reprint of the 1934 edition. It contains brief but clear descriptions, illustrated in colour, of 15 sorts of edible and 9 sorts of poisonous fungi. A glossary of the terms used is included.

422. HODSON, W. E. H. 635.944 : 632.7
Narcissus pests.

Bull. Minist. Agric., Lond., 51, 2nd edit., 1939, pp. 44, bibl. 40, 1s.

The bulletin summarizes in a practical manner the knowledge of the principal pests of narcissus. It is pointed out that these are often exceedingly destructive and are capable, if unchecked, of ruining a plantation. A material advance in knowledge as to the efficient application of the hot water treatment has occurred since the publication of the first edition in 1933. This has been incorporated in the bulletin and is based almost entirely on the work of Staniland and Barker.* The pests dealt with are the narcissus fly, the small bulb flies, eelworm, mites and slugs.

423. MINISTRY OF AGRICULTURE, LONDON. 635.31
Asparagus.

Bull. Minist. Agric., Lond., 60, 1939, pp. 55, bibl. 8, 1s.

This is a reprint with amendments of the 1934 edition. It contains directions for cultivating and harvesting, notes on business organization for growing and marketing in this country and on the experimental work done under the Worcestershire C.C., the Kirtou Institute and the Royal Horticultural Society. Foreign practice is not neglected and notes are given of forcing and ordinary methods used in France, Italy and Germany and of ordinary cultivation in U.S.A. and in the above countries. Diseases and pests are touched on. Appendix 1 gives details of grade designations and appendix 2 standard methods of tying and packing accepted for graded asparagus in England.

424. TAYLOR, H. V., AND JOHNSTONE, K. H. 635.944
Commercial bulb production.

Bull. Minist. Agric., Lond., 62, 2nd edit., 1938, pp. 92, bibl. in text, 1s. 6d.

This second edition has been revised and brought up to date in view of the important results of recent research on bulb production in England. The major bulb crops dealt with are narcissi, tulips, gladioli, lilies, and irises, while a number of the smaller sorts such as fritillaria and crocus, snowdrop, etc., are more briefly mentioned. The bulletin is written from the standpoint of bulb, not flower, production. The latter has been dealt with in other bulletins.

425. TAYLOR, H. V., AND JOHNSTONE, K. H. 635.9
Commercial flower production. Part I. Spring flowers and flowers grown under glass.

Bull. Minist. Agric., Lond., 96, 2nd edit., 1939, pp. 84, bibl. in text, 2s. 6d.

The first edition was abstracted in *H.A.*, 1937, 7 : 792. The present edition has been enlarged by some 7 pp. Parts II, III and IV, entitled respectively Summer flowers, Foliage, and Flowering plants in pots, have also appeared and been noted in *H.A.*

426. TAYLOR, H. V., AND JOHNSTONE, K. H. 635.9 : 631.346
Commercial flower production. Part IV. Flowering plants in pots.

Bull. Minist. Agric., Lond., 112, 1939, pp. 55, bibl. in text, 2s.

An account is given of the methods of production of the varieties of plants commercially grown in pots for decoration. There is also a section on summer bedding plants produced in pots or trays for subsequent planting. Before dealing with the varieties individual chapters are provided on general considerations, e.g. pots, composts, manures, on propagation, in which the possible utility of growth hormones is discussed, and on routine management, in which the proper methods of watering are stressed.

* *Bull. Minist. Agric.* 105, 1937.

427. MOORE, W. C. 635.944 : 632.3/4
Diseases of bulbs.

Bull. Minist. Agric., Lond., **117**, 1939, pp. 176, bibl. 709, 4s.

Bulletin No. 117 may be regarded as supplementary to Bulletin No. 62, Commercial bulb production. It describes the diseases found in this country on plants raised from "bulbs" (including corms and rhizomes), and its aim, as set out in the introduction, is "to provide the grower with an account in popular language of the symptoms, spread and control of each of the common diseases, and to furnish the plant pathologist and research worker with a guide to the literature on the more uncommon diseases and on the technical aspects of the subject". This Bulletin No. 117 will serve the purpose admirably, for it contains clear descriptions of all those diseases that the grower of "bulbs" is likely to encounter, and sets out the measures for controlling them. More than 50 diseases are described. It is illustrated by 58 excellent figures reproduced from photographs. The three families of plants dealt with and the species subject to the diseases described are:—*Liliaceae*: Hyacinth, tulip, lily and *Bulbocodium*, *Chionodoxa*, *Colchicum*, *Convallaria*, *Fritillaria*, *Muscari*, *Ornithogalum*, *Scilla*. *Amaryllidaceae*: Narcissus, snowdrop. *Iridaceae*: Gladiolus, iris, crocus and *Freezia*, *Ixia*, *Montbretia*, *Tigridia*. A short historical account is given of each of the important diseases, and this together with the references given will form a useful introduction for any research worker who wishes to make a special study of any particular disease. H.W.

428. MINISTRY OF AGRICULTURE, LONDON. 635.1
Root vegetables.

Bull. Minist. Agric., Lond., **120**, 1939, pp. 17, 6d.

Brief notes are given of the cultivation and, where possible, of the best varieties of the following vegetables:—carrot, parsnip, turnip, swede, beetroot, Jerusalem artichoke, salsify (*Tragopogon porrifolium*), scorzonera (*Scorzonera hispanica*), celeriac, kohlrabi and skirrets (*Sium Sisarum*). In an appendix are given the percentage analysis of most of them and certain details of their vitamin content. Particulars are also given of the normal imports of carrots.

429. SCIENCE MUSEUM LIBRARY, LONDON. 016 : 016
List of publications (stencilled).
 South Kensington, London, S.W.7, pp. 24.

This stencil, while noting the other publications available at the Science Library, consists essentially of a list of bibliographies on pure and applied botany and related subjects compiled and available there. The number of references is given in each case.

430. CEYLON, JOURNAL OF SCIENCE. 016
Catalogue of the contents of the Ceylon Journal of Science publications.

Ceylon Govt. Press, Colombo, 1939, pp. 77.

The entries date from 1901 and comprise all the scientific papers published in the *Annals of the Royal Botanic Gardens*, *Peradeniya*, *Spolia Zeylanica*, the *Bulletins of the Ceylon Fisheries* and the *Ceylon Journal of Science* in which the above journals were finally merged. There are six sections divided as follows:—(A) Botany, (B) Zoology and Geology, (C) Fisheries, (D) Medical Science, (E) Meteorology, (G) Archæology, Ethnology, etc. The author and subject indexes show some slight inaccuracies which, however, do not greatly detract from their value.

431. CANADA, DEPARTMENT OF AGRICULTURE. 083 : 63
List of publications 1939.

Publ. Dep. Agric. Canada **526**, 1939, pp. 15, being *Fmrs' Bull.* **14**.

CANADA, NATIONAL RESEARCH COUNCIL.

Publications of the National Research Council of Canada. 1918-1938.

Ottawa, 1939, pp. 38 + 6. (Supplementary list.)

432. CANADA, NATIONAL RESEARCH COUNCIL. 577.15.04 + 664.84/85

***Twenty-first Annual Report for 1937-8*, 1939, pp. 178, \$0.75.**

The chief interest of this report to the horticulturist lies in the continued work on the practical application of plant hormones. Patent applications have been filed on three processes :—dusting of seeds to stimulate germination and early growth, the hormone being incorporated with an inert dust like talc or with a standard fungicidal dust ; dusting of cuttings to stimulate root formation ; addition of hormone to chemical solutions used in seed treatment to protect the seed from loss of germinating power. A simple method of treating seeds has been developed. It makes use of a dust-carrier, either inert or a seed disinfectant. Treatment of cuttings with hormone-containing dusts has also proved very successful. Application of plant hormones to growing plants is found to result in stimulated growth over a given range of treatment. Laboratory observations suggest the possibility of applying the synthetic chemical with fertilizer in the field. Satisfactory plant hormones are now being prepared for distribution at a reasonable price in commercial laboratories. A series of homologues of α -naphthylacetic acid has been prepared and these are ready for testing. The method of synthesizing α -naphthylacetic acid has been simplified. In connexion with the Horticultural Division, Ottawa, storage investigations have included the effect of nutrition of apple trees in the field on storage quality ; the effect of storage temperature ; the effect of different gas mixtures on apple storage ; the effect of potassic fertilizers in increasing yield and quality of celery grown on muck land.

433. CYPRUS (McDONALD, J.). 634.1/8

***Annual Report of the Department of Agriculture for 1938*, 1939, pp. 51, 3s.**

This most readable report with its strong horticultural bias contains a mass of information of a statistical and mainly routine nature. It may be noted that at the Famagusta Citrus Experiment Station in the Jaffa orange rootstock experiment the heaviest yield came from the trees budded on bitter orange stocks, which after their usual slow start have now overtaken the trees on sweet lime. Both are ahead of those on sour lemon. Work at the Trikoukkia Deciduous Fruit Station is concerned with varietal and stock trials. Varietal trials are also in progress at the Saittas Vine Experiment Station. Other work includes trials on tung oil trees and hazel nuts. Sericulture is being studied at the Sericulture Station, Kalopanayiotis. Trials on various pests, some of them horticultural, are reported by the entomologist. Mycological work has been largely routine.

434. HORTICULTURAL EDUCATION ASSOCIATION. 634/5

***Occasional publication*, November, 1939, including reports to the annual general meeting, 1939, and list of members. Gibbs & Sons, Orange Street, Canterbury, 1939, pp. 32.**

These are reports and accounts, which in peace time would have been incorporated in the Council's Report to the Annual General Meeting. The publication includes a few book reviews, the list of members and an obituary notice, which would have appeared in *Scientific Horticulture*, had the publication of that valuable annual not been temporarily suspended for war reasons.

435. INDIAN TEA ASSOCIATION, SCIENTIFIC DEPARTMENT. 633.72

***Annual Report of Toklai Experimental Station for 1938*, 1939, pp. 40.**

Research results of interest are :—*Young tea*. With young tea which has to be planted on the site of old plantations the use of potash increased weight of prunings and leaf crop in the second and third years from seed. Overdoses of nitrogen on young tea are harmful ; 20 lb. per acre produced better growth than 60 lb. Phosphate did not affect growth but increased resistance to red spider. These findings are elaborated in appendix 1. During the year 90,000 cuttings were taken from selected bushes, of which 26,000 are still alive (at date of publication). Considerable inter-bush differences in ease of rooting were shown. Tea pollination, see abstract 352. Manuring for quality in second flush teas, 60 lb. N, 30 lb. P, 30 lb. K was ineffective in this

respect (appendix 2). No loss in quality in made tea could be distinguished as between cattle and artificial manures applied either early or late in the season. The degree of acidity of the soil was found to have no effect upon quality of made tea. Some aspects of fermentation are discussed. Bitumen mixed with kerosene is a wound paint for pruning cuts which affords good protection and stimulates callusing. It is best applied immediately after the cut is made. *Boga medecola* grown among tea and the green parts hoed into the soil in 1936 has shown a residual effect lasting 3 years. The total increase in yield from the use of *Boga* for 2 years is 6.6 mds. tea per acre against a total crop increase over a similar period of $4\frac{1}{2}$ mds. following the annual application of 30 lb. nitrogen as sulphate of ammonia.

436. I.N.E.A.C. 633/635
Rapport annuel pour l'exercice 1938 de l'institut national pour l'étude agronomique du Congo Belge. (Annual Report of I.N.E.A.C. for 1938.)
 Part I, 1939, pp. 269, 25 Fr.

The report gives a general account of the work of the Institute which is charged with the development of agriculture in the Belgian Congo and controls numerous experiment stations and sub-stations. The experiments in progress are only briefly mentioned as are any results obtained. Many of the stations are quite new and little can be expected from them yet.

437. JOHN INNES. 634/5 : 631.521
29th Annual Report of the John Innes horticultural Institution for 1938, 1939, pp. 23.

Notes of interest to horticulturists refer to work of a genetical or pomological nature on the following :—*Primula sinensis*, *Streptocarpus*, *Lathyrus*, *Verbena*, *Pisum*, *Lotus*, *Tropaeolum*, *Rubus*, *Pyrus*, *Prunus*, *Solanum*.

438. KENYA. 633.73 +632.951.1 +588.427
Annual Report of the Department of Agriculture for 1938, 1939,
 vols. I and II, pp. 138 and 81.

The report contains an account of the activities of the agricultural department during 1938. *Coffee*. In the research section a number of primary parasites on the mealy bug of coffee (*Pseudococcus kenyae*) have been imported from other parts of East Africa and successfully multiplied in sufficient quantities for liberation. For cultural work many experiments are being run in conjunction with planters. The bordeaux spraying experiments continue to give results heavily in favour of bordeaux. The taint in liquor of certain coffees is being investigated and the possibility of its correlation with too high a leaf to crop ratio is under examination. A new technique has been evolved for treating cuttings with growth substances. The cuttings are stood in a solution of the growth substance contained in a vacuum desiccator. The air is exhausted from the desiccator and consequently also from the cuttings. The vacuum is then broken and the returning pressure of air forces the solution into the basal parts of the cuttings. The whole process occupies only 10 minutes instead of the usual 12-18 hours with the ordinary method. It is particularly useful with leafless cuttings which often fail to absorb the solution when treated in the ordinary way. These and many other experiments and trials still in progress are briefly described. In soil chemistry three investigations have been concluded :—(1) the very good reserve of potash in the major coffee soil (Kikuyu red loam) has been established ; (2) the presence of differences in different cups of the same roast has, it is thought, been traced to the chance presence of very few inferior coffee beans which exert an influence on the whole ; (3) field and laboratory work on the reduction of the pollution of streams by coffee factory effluents have been completed. *Pyrethrum*. Damage to flower heads by thrips was controlled by spraying with a proprietary nicotine sulphate 1 : 600 or even 800. If lime-sulphur is used it is only effective when applied after the plants have been cut down to near soil level. This method is

recommended and should be done soon after the season's picking is finished. The reason for a progressive drop in pyrethrum content as the season advances has not been definitely determined but may be due to forcing the crops to continue cropping by not cutting back in the dry season. Faulty drying is also suggested as a contributory cause. *Passion fruit*. The woodiness disease of passion fruit which has assumed serious local importance has been proved to be caused by a transmissible virus.

439. LOUISIANA (WILSON, W. F., JR.). 634.75 + 633.841
Biennial Report of the Fruit and Truck Experiment Station, Hammond, Louisiana, 1937-8, 1939, pp. 29.

Brief accounts are given of the following work:—*Strawberries*. Four-year trials suggest that the best fertilizer under Louisiana conditions is 4-12-4 combination at 1,200-1,500 lb. per acre. Spacing at 10 inches apart in single rows 3 feet wide gives better results than wider spacing with double rows. Green manuring prior to strawberry growing should only be done with caution. Transplanting with a block of soil attached to the roots resulted in considerably increased yield of early fruit. Liming so as to decrease acidity to pH 6.1 was beneficial. *Peppers*. Fertilizer, liming and variety tests are reported.

Other experiments include cultivation trials with Satsuma orange and tung oil, mayhaws, bilberries, dewberries, blackberries, pecan varieties. Investigations on diseases have included the following:—strawberry diseases, blackberry and dewberry rosette, crown girdle of pear and tung, *Cercospora* leaf spot of peppers, cucumber downy mildew.

440. MALAYA (BELGRAVE, W. N. C.). 633/635
Annual Report of the Departments of Agriculture, Malaya, for 1938, 1939, pp. 91. 2s. 4d.

Some results from the Central Experiment Station are included in this report of the work of the Department of Agriculture. A few are quoted below. *Oil palm*. During 1937-8 phosphates alone gave more economical results in increase of yield than NPK, NP, PK and nil. Lessened yields from wilt reduces the value of the deductions. Sand proved a better germinating medium for fresh or soaked seed than pericarp refuse. Barium carbonate mixed with talc or lime does not lump and dusted on flowers and fruit it deterred rats completely without injury to the plant. Clean weeding gave increased yields over uncontrolled or periodically slashed weed growth. In the Division of Chemistry an interesting discovery was made in connexion with bleaching palm oil with activated fullers' earth. It was found possible to recover the absorbed pigment from the used earth by treating the latter with petroleum ether to remove most of the oil and then suspending the oil-free earth in acetone in which the coloured pigment is soluble. This method would appear very suitable for isolating carotene from the oil. *Tea*. Progress report on new manurial experiment shows that so far plots receiving only N alone yielded a crop equal to full dressings. Tea seed bearers yielded up to 900 lb. of cleaned seed per acre, far higher than any previous yield. *Coffee*. Increased yields were obtained by mulching, also by a treatment combining 4 cwt. rock phosphate and 2 tons of green manure per acre but not by 4 cwt. rock phosphate alone. *Derris*. Results are reported in abstracts 240-2. *Fruit*. Stocks of *Nephelium lappaceum* and *N. mutabile* (rambutan and pulasan) have proved incompatible with buds of *N. malaiense*. Durian buds taken from ringed shoots gave increased takes over those from unringed branches of the same tree. Ring barking of stocks 1-5 days before budding above the ring had no effect. *Cacao*. A superior technique in controlled pollination has been worked out (not described). *Tapioca*. Maintenance of soil fertility under continuous cropping. With the fifth successive crop, farmyard manure, 10 tons per acre, gave considerably higher yields than complete chemical dressings and than green manure with basic slag. *Pepper*. Provisional results indicate that both 800 lb. prawn dust per acre and 200 lb. sulphate of potash gave better results than the other dressings under trial. Vines on living supports (*Gliricidia maculata*) gave lower yields than those on seasoned wood and probably always will.

441. RUBBER RESEARCH INSTITUTE OF MALAYA. 633.912
Annual Report of the Rubber Research Institute, Malaya, for 1938,
 1939, pp. 226, 1s.

The activities of the various Divisions of the Rubber Research Institute are fully set out. A great number of experiments are in progress; notes are given on these and the results, where available, are discussed.

442. FRUITGROWERS' FEDERATION OF N.S. WALES. 634.1/8
Official Yearbook 1938-9, 1939, pp. 127.
 Watson House, 11 Bligh St., Sydney.

This book is full of practical information particularly useful to the N.S. Wales fruit grower. Information is contained on the following among other subjects:—*Fruit culture and small farming*, the organ of the Federation; N.S.W. fruit statistics, acreage, production, imports and exports; Plant Diseases Act 1924, extracts including parts relating to codling moth, fruit fly, waste fruit pits, red scale of citrus, grading regulations for all kinds of fruit; report of royal commission of inquiry into the fruit industry of N.S.W.; railway freights for fruit, vegetables and fertilizers; Sydney markets; agricultural lime.

443. NEW ZEALAND. 634.1/8
Annual Report of the N.Z. Department of Agriculture for 1938-9,
 1939, pp. 71.

The Director of the Division of Horticulture, W. K. Dallas, surveys on pages 60-71 the fortunes of the horticultural community in 1938-9. He considers exports, local markets for fruit and vegetables, the organization of market gardeners, imports and exports of fruits and plants, cold storage, instructional work, viticulture and wine making, cider making—this being on the increase—, Te Kauwhata Horticultural Station, tobacco culture, hop culture, nursery and orchard registration, bee-keeping.

444. NEW ZEALAND D.S.I.R. 634/5
Scientific and industrial research 1927-38.
Bull. N.Z. Dep. sci. industr. Res. 69, 1938, pp. 113, 2s. 6d.

This is a concise review in non-technical language of the work and achievements of the D.S.I.R. in the last eleven years. Horticulturists will perhaps be most interested in the following:—*Fruit research* (44-51). Early investigations dealt largely with the nutrition of apple trees, the diseases of cold storage, and the development of suitable spray programmes. As these lines of work are all essentially long-term projects of constantly widening scope, they still occupy the foremost place in the present programme. The chief subsequent developments are rootstock and scion experiments, oversea transport experiments, tests on the effects of refrigerated gas storage, experiments on the manufacture of unfermented apple juice, and extension of studies to other fruits such as citrus.

Plant research bureau (20-37). This bureau is charged with the task of improving through selection and breeding New Zealand's horticultural and plantation crops and of organizing the plant protection service.

Tobacco research (68-70). The main items of research in New Zealand are tobacco-seed diseases, control of mosaic disease, and chemical investigations of tobacco soils and the quality of tobacco leaf.

Phormium research (71-3). This has included selection and breeding trials, improvement in design of stripper, chemical composition of the leaves and fibres of *Phormium tenax* (N.Z. flax).

445. NEW ZEALAND D.S.I.R. 634.1/8 +664.85
Thirteenth Annual Report of the Department of Scientific and Industrial Research for 1939, pp. 134.

Secretary's report on fruit research (p. 11). Among items of research noted are:—opening of new laboratories and experimental area at Auckland; fertilizer experiments at Appleby; control of

premature defoliation in Jonathan apple by injection of magnesium salts; control of brown spotting in apricots by boron sprays or top dressings; preparation of palatable apple juice from New Zealand varieties; use of copper-treated wraps for control of grey mould in stored pears; gas storage of Ballarat and Washington apples.

Report of Research Committee on Fruit (pp. 66-72). Items briefly discussed include:—fertilizer experiments with six apple varieties; rootstock experiments, now still in their infancy; inarching experiments—no increase in vigour reported yet; apple variety trials; pruning systems. Plant protection experiments as affecting apples and stone fruits include entomological, mycological and physiological studies, spraying experiments and testing of therapeutants. Pear bud wilt is being investigated and cherry rootstock trials are in progress. As regards small fruits studies have continued on two raspberry pests, namely the bud moth *Carposina adreptella* and the sawfly *Priophorus tener*, on a gooseberry stem wilt, on woodiness in passion fruit discovered to be due to virus, and on mealy bug of grapes successfully controlled by live steam. The following apples have been tested for their suitability as a source of commercial juice extraction:—Cox's Orange, Dunn's Favourite, Jonathan, Delicious, Statesman and Sturmer. Work on citrus concerns:—nursery trials of citronelle, sweet orange, sour orange and trifoliate orange; red- and white-wax scales; dicky-rice weevil (*Maleuterpes spinipes*); mottle leaf control by manganese sulphate applied in combination with hydrated lime as a spray.

Report of Research Committee on Fruit Cold Storage (pp. 73-5). This report contains notes on:—the refrigerated gas store completed in 1937; provision of improved facilities for pre-cooling and storage of fruit in Wellington and other main terminal ports; staining of pears by wrapping pads in which sodium silicate was used as adhesive but not by pads treated with dextrin or by plain white lining paper or shredded white paper; successful use of copper-treated wraps for control of grey mould (*Botrytis*) in pears; beneficial effects of immediate storage of pears; control of and some factors influencing superficial scald in Granny Smith apples; effect of fertilizer treatment on storage quality of Cox's Orange, Dunn's Favourite, Delicious, Jonathan and Sturmer apples; effect of boron on keeping quality of apples; gas storage of Ballarat and Washington apples.

446. BREMER, A. H., BRANDTSEGG, O., AND SOELBERG, C. 635.1/7
Melding frå Statens forskastasjon i grønsakdyrking. Kvithamar i Stjørdal.
(Report of the Vegetable Research Station, Norway, 1937-38.)
Grøndahl & sons boktrykkeri, Oslo, 1939, pp. 47.

The report deals with the following subjects:—

I. Vegetable growing in the highlands and in northern Norway. This includes notes on cabbage fly control and on the necessity for giving the plants a good start in view of the short growing season. II. Winter cabbage in Trøndelag—yields, storage and nutritional value. III. The use of glass and wax paper to collect solar heat. Under this heading the author deals with the following:—pickling cucumbers; paper hoods for early cabbage and their preparation; the use of wax paper as a protective and ray collecting material to induce vigour. IV. Crops to follow transplanted glasshouse cucumbers. V. Peas. VI. Storage of cauliflower, in cellars, outhouses or snow. VII. Publications of the institute 1937-8.

447. PENNSYLVANIA. 634.1/7
**52nd Annual Report of Pennsylvania Agricultural Experiment
Station for the fiscal year ended June 30, 1939**, 1939, pp. 77, being
Bull. 382.

Among horticultural investigations the following may be noted. *Rooting of apple cuttings*. Rooting was not obtained by the use of indolylbutyric acid in apple cuttings of Malling XV or of Stayman. *Wound dressings*. Plain lanolin added to ordinary grafting wax improved its physical properties. *Breeding of sweet corn, peppers, tomatoes, lettuce, cabbage and snapdragon*. Treatment of *Ilex opaca*, *Chamaecyparis obtusa crippei*, *Taxus media hicksi*, and *Thuja occidentalis wareana* with Rootone, which contains naphthalene acetic acid in powder form, resulted in increased rooting.

448. SOUTH AFRICA, UNION OF. 634.1/8
Annual Report of the Department of Agriculture for year ended 31 August 1939.
Fmg S. Afr., 1939, 14: 467-594.

This number contains the full text of the annual report of the Department of Agriculture, the reports of the heads of the various Divisions and Research Stations, and that of the Stellenbosch-Elzenburg College of Agriculture. Any original published research of interest to this Bureau has already been dealt with in *Horticultural Abstracts* as the papers appeared.

449. WEST VIRGINIA. 634.1/7
Report of the Director of W. Virginia Agricultural Experiment Station, Morgantown, for Biennium 1936-8, being *Bull.* 290,* pp. 53.

The director in this popular account of two years' investigations makes among others the following points:—Dwarfing apple stocks have not given encouraging results. Thus Red Rome trees on Malling I need propping and mice show a preference for Malling IX. Work is in progress on blueberry propagation from cuttings with the aid of indolylacetic acid. It has been found possible to keep walnut kernels fresh and in good condition for several years by storing in vacuum or nitrogen at temperatures near freezing point.

450.
 The annual reports and similar publications listed below have also been examined. Much of the horticultural work referred to in them has been dealt with more fully elsewhere and abstracted in *Horticultural Abstracts*.

Rep. agric. Dep. Antigua for 1938, 1939, pp. 45, 6d.
Administ. Rep. Director Agric. British Guiana for 1938, 1939, pp. 41.
Rep. agric. Stats. of Dep. Agric. Burma for year ended 31 March, 1939, 1939, pp. 239, 9s.
Rep. Work Rubb. Res. Board, Ceylon, in 1938, 1939, pp. 96.
Rep. agric. Dep. Dominica for 1938, 1939, pp. 25, 6d.
Eighth A.R. Minister Agric. Eire, 1938-9, 1940, pp. 175 +appendixes, pp. 89, 2s. 6d.
Rep. Dep. Agric. Gold Coast Colony for 1937-9, 1939, pp. 22, 2s.
A.R. Agric. Dep. Grenada for 1938, 1939, pp. 25, 6d.
Malayan Agricultural Statistics 1938. (Grist, D. H.)
Econ. Ser. Bull. Dep. Agric. S.S. and F.M.S. 10, 1939, pp. tab. 102.
Rep. agric. Dep. Montserrat for the three years 1936, 1937, 1938, 1939, pp. 33, 6d.
Scientific Reports of the Imperial Research Institute, New Delhi, for the year ending 30 June 1938, 1939, pp. 131.
A.R. Dep. Agric. Seychelles for 1938, 1939, pp. 22.
A.R. Dep. Agric. Tanganyika Territory for 1938, 1939, pp. 61, 2s.
A.R. Field Experiments on Sugar-Cane in Trinidad for 1939. (Turner, P. E.) Sugar Cane Investigation Cttee, Trinidad, 1939, pp. 262.
A.R. Dep. Agric. Uganda Protectorate for 1938, 1939, Part I, pp. 69, 3s.; Part II, pp. 99, 4s.

* Entitled "Epistle to the farm", and issued by C. R. Orton, Director.

